THE ENGINEERING AND MINING JOURNAL.

HENRY W. TROY—DEL. COLLINS & SHUGG, SC.

VOL. XI.—No. 12.—THIRD SERIES.] NEW YORK, TUESDAY, MARCH 21, 1871. [SINGLE COPIES 10 CENTS.

The Effects of Cold on Iron and Steel.

THE following paper on the effect of variations of temperature on the strength of iron and steel, read at the last meeting of the Manchester (England) Literary and Scientific Society, will be perused with much interest by a large number of our readers.

Mr. WILLIAM BROCKBANK, F.G.S., read "Notes on the Effects of Cold upon the Strength of Iron." The severity of the present winter, he said, has brought the question of the effects of low temperature upon the strength of iron very prominently before the public, and it is a curious circumstance that a subject of so great importance should have escaped the attention of writers on iron to such an extent, as that it is either ignored or dismissed with a few brief remarks or inconclusive experiments, which leave the subject altogether unsettled. After referring to the observations and experiments on the effects of low temperatures on the strength of cast and wrought iron in the works of Sir W. FAIRBAIRN, Dr. PERCY and DAVID KIRKALDY, and pointing out the inconclusiveness of all the experiments hitherto recorded, the writer went on to detail the following experiments, which he had, by the kindness of the several parties named, caused to be made during the severe frosts which have recently prevailed, and which have in all cases been carried out with the greatest care and exactness. Experiments on the transverse strain of cast-iron bars were made at the works of Messrs. P. R. JACKSON & Co., of Salford, and were repeated thrice, with the following results: In Mr. FAIRBAIRN's experiments only one sort of pig iron was employed. It is now well known that a much sounder and more regular casting can be obtained by a judicious admixture of several suitable kinds of pig iron; a very probable source of error would thus occur in Mr. FAIRBAIRN's experiments, and this will probably point to the unsatisfactory results he obtained. The bars employed in the present experiments were made from a mixture of four pig irons of the highest class, added to some good scrap iron; they were all poured from the same ladle, and were moulded from the same model, and they were remarkably regular in size and quality, so that the results may be fairly relied on. The castings were all made on Friday, the 30th of December last, and the bars were tested on the following Tuesday, January 3, 1871. The machine used was a powerful lever or steel yard, the bars having a three feet bearing, and the results were taken with all possible care. Experiments upon the transverse strain of cast iron at low temperature were made at the works of Messrs. P. R. JACKSON & Co., Salford, January 3, 1871, by W. BROCKBANK, F.G.S. The mixture of metals was Cleator hematite, Pontypool cold blast, Blaenavon cold blast, and Glengarnock hot blast pig iron, with some good scrap iron. All the bars cast from one ladle. The results showed a gradual and considerable decrease of strength in the bars, with the increase of cold below the freezing point. They also lost their elasticity in a similar degree. A further trial was made at Messrs. JACKSON's works with similar bars, and the same admixture of metals, January 10. These experiments are borne out by the general experience of ironfounders, many instances having come to his knowledge during these investigations, a few examples of which may be cited.

1. He found it a matter of general opinion that pig iron breaks much more easily in frost than in ordinary temperatures, and that breakages of castings are much more frequent in frosty weather. 2. In rolling mills, and particularly where chilled rolls are employed, especial care has to be used in frosty weather to warm the rolls before using them, and when in use to keep them carefully covered from the frosty air. If not properly protected and carefully managed they are found to be very liable to fracture. Mr. EDGAR GILKES, of Middlesbrough, informed him that the cast-iron wheels of the chaldron wagons of the Stockton and Darlington railway are found to fracture very frequently in frosty weather, and in a severe frost it is sometimes quite a serious matter. 4. Messrs. PEEL, WILLIAMS, and PEEL had a remarkable example on January 5 (20 degs. F.) An hydraulic cylinder had been cast upon a cast-iron hollow core bar 7 inches in diameter and 1¼ inch thick, coated with 1½ inch of loam and hay. It was put out in the yard to cool during the severe frost, and when they came to draw the core bar it broke by the mere torsion, and was found to be quite brittle. A portion of this core bar was warmed, and it was then found to have recovered its nature, and to be quite strong and tough. The lowest temperature on this date was 19 degs. F., and the casting was exposed to it for many hours. Numerous other examples could be readily furnished if required. There can, therefore, be no doubt whatever that the strength of cast iron is very materially lessened by cold. For experiments in wrought iron he was indebted to many friends, and the results are of similar import. His first experiments were directed to the method adopted by Mr. KIRKALDY, and he soon found that neither by torsion nor gradual tensile strain could the true result be ascertained, as the bar almost immediately became heated under the strain, and the effects of frost at once disappeared. The following experiments, made by Mr. WILLIAM JOHNSON, of the Messrs. JOHNSON's Iron Works, Bradford, near Manchester, will illustrate this conclusively. A coil of galvanised wire, 5½ B. W. gauge, was left in the open air for twenty-four hours during severe frost, December 24, 1870; twenty-four pieces, 1 yard in length each, were then cut off; of these six were tested for tensile strength by the direct application of weights, and six for torsion—the same tests were used for the remaining twelve after they had been warmed to about 80 degs. The results were as follows:

Tension.		Torsion.	
At 20° lb.	At 80° lb.	At 20° Twists.	At 80° Twists.
2,142	2,142	16½	14½
2,114	2,058	15½	14½
2,114	2,086	9	13½
2,142	2,086	14½	14½
2,114	2,128	16	12½
2,114	2,086	18½	14
Total....12,740	12,586	90	83½
Average 2,123.3	2,097.6	15	13.9

Thus, in both experiments, the iron tests were worse when warm than when frozen. In each case the wire immediately became warm. Mr. F. MONES, of the Whitecross wire works, Warrington, also tested wire rods for him, with precisely similar results. Finding these experiments to be unsatisfactory, he arranged for a series to be tried by the more rough-and-ready method of the striker's hammer, which he judged would be more likely to show the true state of the iron in its frozen condition. The result either of gradual torsion or tension is to expel the frost there may be in the bar almost immediately, so that in the further progress of the trial there is no difference between bars which were originally either cold or warm. If low temperatures have any influence in rendering iron weaker or more brittle, the only way in which the amount of such influence can be realized is by a sudden impact, and the striker's hammer was the readiest appliance for the purpose. In the following experiments great care was taken that the blows should be as nearly as possible of the same force in each trial, and as the experiments were all carefully conducted, and are vouched for by the parties named, they may be fairly relied on as representing truly the facts or the case. 1. WILLIAM BOUCH, Esq., C.E., engineer of the Stockton and Darlington railway, made the following experiment, December 29, 1870, the temperature at the time being 26°, but it had been as low as 19° over night. A bar of round iron, 1½ inches diameter, of best quality, was taken from the yard, being then coated with ice; it had been exposed to a week's hard frost. It was held over the edge of a smith's anvil, and one blow from a twelve-pound hammer by the striker broke a piece, four inches long, short off, the fragment flying twelve yards along the floor of the workshop. The same bar was then put into the mouth of a furnace, but not in contact with any flame, for a short time, to unfreeze it. The heat received into the bar was so moderate that a smith could grasp it with his hand. It was then allowed to lie on the floor for some time, until it had quite cooled down to the temperature of the workshop. It was now placed on the anvil, and the same striker as in the first experiment, with the same hammer, gave fourteen blows without causing the slightest fracture, the bar being merely bent about two inches. Mr. BOUCH adds that he has, in his experience, met with many cases nearly as convincing as the above. 2. Mr. ROBERT PEEL, of Messrs. PEEL, WILLIAMS & PEEL, Manchester, had kindly made for him the two following experiments with boiler-plate iron, as shown by the samples now on the table, viz., No. 1. A strip of boiler plate of the best quality was taken from the open yard, where it had lain during several days of severe frost, January 5th, 1871, temperature about 20° Fahr. It was laid across the anvil, and a striker, with a single blow of a fourteen-pound hammer, broke off the piece now exhibited. The fracture shows a very "short," crystalline face, without any appearance of fibre, and is torn and irregular, in remarkable contrast to sample No. 2, which is from the same piece, viz., No. 2. The remainder of the above strip was slightly warmed to dispel the frost, and then allowed to cool to the temperature of the shop. It required several blows from the same hammer, and bent considerably before breaking, being exceedingly tough and fibrous. The fracture shows a good fibrous structure, except on the inner side of the curve, where there is a thin, crystalline skin. The difference of appearance in these two fractures is very striking and remarkable, and can only be accounted for by the action of extreme cold.

No. 1A. This experiment was made on January 6th, temperature about 26° Fahr. A strip of Low Moor best boiler plate was taken out of the snow, having lain there during several days of intense frost. It was laid across the anvil, and broken off short with a single blow from a fourteen-pound hammer. The fracture is fibrous, but with patches of crystals, especially on the edges of the plate; the general appearance is "short" or "tender," very different from the usual character of Low Moor iron in its normal state.

No. 2A. The remainder of the same strip was placed in the drawing-office, at a temperature of 70°, and allowed to lie there for some hours. It then required six blows from a fourteen-pound hammer, the plate being reversed each time, the grain being thus severely bent backwards and forwards, under heavy blows, before it severed. The outer skin still remained in cohesion, and it had to be separated by bending backwards and forwards in the smith's hands. This fracture shows a splendid quality of iron, the fibre being bent in both directions as the blows were alternately reversed. There is a slight crystalline line on the skin of one side.

Mr. F. MONES, of the Whitecross Wire Company, Warrington, had kindly made the following experiments with wire billets, which are the very toughest form of iron manufactured. The wire exhibited is made from one of the same bars, and will clearly show the quality of the iron. The billets are 1¼ in. square, being in the semi-manufactured form ready for the final heating and rerolling into wire. They had been lying in the open air several days during severe frost. Experiment tried January 1st, 1870, 10° lowest to 30° highest temperatures. Three bars were broken in the open air. They failed to break with twenty-two blows with a fifteen-pound hammer. A small nick ⅛ in. deep was then cut, with three light blows on a "set," in the top of each bar, and at another part of it, after which a single blow sufficed to break each bar. The bars were then thawed and allowed to cool to the usual temperature, or about 70°; twenty-two blows were given to each as before, and the same nick was made on one side as nearly as possible like the frozen bars had been treated. One bar then broke after eleven blows, one after ten blows, and one after six blows. The frosted bars are more crystalline, and show no signs of fibre; the other bars show a good amount of fibre, and are slightly crystalline in the fractures.

The following experiments with rails were made at the works of the Darlington Iron Company, November 30, 1869: The rails were taken promiscuously from a lot of 1,000, all supposed to be of the same quality, weight, and exact section. It had been found that the rails which were then in course of manufacture for the East Indian Railways at these works, and which were of a very high quality, failed to pass the required test in frosty weather, whereas in ordinary temperatures a failure was a very rare occurrence. The ten rails were accordingly selected to settle the question whether higher and lower temperature affected the strength of the rails. Four rails were heated up to 120° Fahr.; the other six were tested cold, the temperature of the atmosphere being about 26°. At 120° all the bars stood two 5 ft. blows and one 7 ft. blow. At 26° only one bar stood two 5 ft. blows, three broke at the second 5 ft. blow, and one at the first 5 ft. blow. At 60° all would probably have passed the test easily, many thousands having previously done so from the same lot. It will therefore be seen that the results are in perfect agreement in all these experiments, showing that bar iron, boiler plates, wire billets, and rails are most materially weakened by the action of intense cold, losing all their toughness, becoming quite brittle under sudden impact, and having their structures changed from fibrous to crystalline. Similar instances could be given in illustration of this in the daily practice of engineering. In large works the breakages of wrought iron are very considerable during frosts. Quarrymen find that their chains are very liable to fracture from the same cause; and doubtless the numerous accidents of failing tyres in our railways may be attributable to it. In many cases, however, the contraction of iron must also be taken into account, as it is a serious item. In conclusion, he thought it could not be doubted, after the above recital, that iron does become very much weaker, both in its cast and wrought state, under the influence of low temperatures. This subject is one of such paramount importance that a careful series of investigations ought to be undertaken by one of our scientific bodies, to ascertain the precise nature of the changes which are thus shown to take place, as there is herein an item which materially affects the stability of all iron structures during frosty weather, and which has not hitherto been adequately recognized.

Operations of Louisiana Petroleum and Coal Oil Company.

II.

THE original artesian well put down by the Petroleum Company reached the depth of three hundred and seventeen feet, but the pipe having sustained a fracture, some sixty feet below the surface, the boring was discontinued in 1867, and the well was finally abandoned. The epidemic of that year and financial embarrassment suspended operations for some time. The

company rallied, however, and employed a more skilful engineer, who commenced another well, within a few feet of the first one, which, in the summer of 1869, had been sunk to the depth of twelve hundred and thirty feet below the surface.

The profile of this well, as indicated by Professor HILGARD, of the University of Mississippi, is as follows:

160 feet, yellow and blue clay, with some sand strata, soaked with petroleum.
173 feet, gray and yellow sand, with gravel, especially below; all soaked with petroleum.
10 feet, blue laminated clay, with a sandstone ledge.
40 feet, blue sandy limestone, in loose rounded fragments, rolling in a stream of water, with gas and petroleum.
60 feet, white crystalline crumbling limestone. Tube driven through.
100 feet, pure crystalline sulphur, strong stream of sulphur water from surface.
147 feet, alternating strata of gypsum and sulphur, as above; about 35 feet of sulphur in all.
540 feet, gypsum, dense, granular, or coarsely crystalline, white or gray, very pure.

1230 feet, to bottom of the well.

The shallowness of what might be termed the oil-bearing rock, as shown by this experiment, precluded the hope of finding petroleum oil in large or paying quantities. The company then turned their attention to the sulphur. The extent of the deposit, and the wonderful purity of the mineral, gave promise of much larger profits, if successfully worked, than could be realized from petroleum.

But here arose the controversy as to the legal construction of the lease held by the company, which led to a resort to the courts, to decide the contest. The company claimed the right to all the sulphur they could take out up to the 5th of October, 1875, the termination of their lease. The land owners, on the other hand, contended that the lease was one to work petroleum only, and not sulphur; and that whatever be the true construction, the company had forfeited their rights by a breach of the conditions of the contract. The ownership of the sulphur was the rock upon which they split.

As the threatened litigation was likely to prove disastrous to both parties, the land owners proposed, as a compromise, to execute a new general mining lease, for ninety-nine years, upon the same terms and conditions as contained in the original petroleum lease. This proposition the company declined. Suit was then entered at once to eject the company and regain possession of the lands.

The court, of the first instance, decided that the lease was not forfeited, and maintained the company in possession until 1875; but rejected the company's claim to all of the sulphur they could take out; and decreed that it should, like the petroleum, be equally divided between the company and the owners of the land. The latter appealed from this decision. Pending the appeal, various offers of compromise were made by the company to the land owners, who now, in turn, refused the terms proposed.

After a hearing, in May, 1870, the Supreme Court of Louisiana reversed the judgment of the court below, decreed the lease of the company to be at an end, and ordered a writ of possession to issue in favor of the owners of the land.

This was a most unfortunate result for the Louisiana Petroleum and Coal Oil Company. They had carried on these works, in spite of the obstacles always attending the pioneers of a new enterprise, for more than four years; had expended many thousands of dollars in developing the real resources of the land; had discovered the existence of the most extraordinary bed of sulphur, perhaps, in the world; and seem to have been fated, under the forms of the law, to sow the seed for others to reap the harvest. It cannot be denied, however, that much of this result is due to the management of the company. It is to be regretted that other counsels did not prevail; but the issue was made, and persisted in, and the decision is now final.

In March, 1870, and during the heat of the litigation, a lease for working all mines upon the lands, for ninety-nine years, was secured from the owners by other parties, who organized the Calcasieu Sulphur and Mining Company of Louisiana, which took possession of the works in July, 1870, and immediately commenced operations preparatory to mining the sulphur. W.

Report on the Allen Engine.

WE make the following extracts from the report of WELLINGTON LEE, C. E., on the experiments conducted last November, for the purpose of ascertaining the economy and effective power of the Allen Engine, shown at the Exhibition of the American Institute.

It was determined to conduct two separate experiments; the first, for the purpose of ascertaining the consumption of coal per hour required for each 1-horse power of work done by the steam in the cylinder, as shown by the indicator diagrams; and the second, to ascertain the per centage of its indicated power that the engine was able to give off in useful effect.

The first of these experiments was conducted on the 3d of November, the engine driving the machinery of the Exhibition, increased, as far as possible, by the addition of two pumps and two large blowers. The next day the belt was removed, and the friction-brake was adjusted to the band-wheel of the engine for the second trial. It was not got in readiness for use, however, until the afternoon of the 5th, the closing day of the Fair, and was then found to be imperfect, and the hurried experiment that was tried showed only the necessity of a greater degree of care and thoroughness in the preparation than was then possible. After the close of the Exhibition, therefore, this trial was repeated, on the 18th and 19th days of November, under my personal supervision, in as public a manner as possible, and in the presence also of two of your number, and of four of the Managers of the Institute, and it was of a character calculated to inspire entire confidence in its results.

The two trials are described, and their results given separately.

DIMENSIONS AND PARTICULARS OF THE ENGINE.

Diameter of Cylinder,	16. ins.
Length of Stroke,	30. "
Revolutions per minute,	125.
Mean piston speed in feet per minute,	625.
Foot pounds of work done per minute in the cylinder, for each one pound of mean pressure,	125,662.5
Horse powers exerted in the cylinder, for each pound of mean pressure,	3.808
Waste room in clearance and passages (cubic inches),	248.
Proportion added thereby to the piston displacement,	.0411
Length added thereby to the stroke (in inches),	1.23
Diameter of fly-wheel, in feet	9.
Weight of fly-wheel (pounds),	7,800.

The engine has four valves, one for admission, and one for release at each end of the cylinder.

All the valves are driven from a link worked by one eccentric.

Total throw of eccentric, 2⅛ inches.

The admission valves are driven from the movable block, adjusted by the action of the governor.

The cut-off is variable, by this automatic action, from the commencement up to the half-stroke.

The exhaust valves are driven from a fixed point at the extremity of the link.

The valves are equilibrium slide valves.

Each admission valve opens four passages into one port. Aggregate length of four openings, 36 inches. Width of each opening, when the steam is cut off at one-fourth of the stroke, ¼ of an inch; when cut off at half stroke, ⅜ of an inch.

Area of admission port, $9 \times 1\frac{1}{2}$ inches$=13\frac{1}{2}$ square inches.

Diameter of steam pipe, 6 inches.

Each exhaust valve opens two passages.

Area of exhaust port and passages, 20 square inches.

Diameter of exhaust pipe, first length and elbow, 7 inches; remainder, 8 inches.

The steam was released at 27.5 inches of the stroke, and compression began at 28 inches of the return stroke.

The cylinder was not steam jacketed, except on one side by the valve chest. On the exhaust side, a belt was interposed to protect it externally from the colder exhaust current. The cylinder was covered with boiler cement cased in wood lagging, except the steam chest, which was polished. The heads were double, and polished. The engine was supplied with steam from the Allen boiler, which, by carrying the water at the middle of the horizontal pipes, superheated the steam in a slight degree.

The steam pipe was well covered with boiler cement.

FIRST TRIAL.

Following the precedent of last year, the water test only was used, and the consumption of coal is calculated, on the assumption that 1 pound of coal burned evaporated 9 pounds of water.*

The boiler was supplied from the tank which had been used for the boiler experiments, and which had a capacity of 25 cubic feet. It was filled by a 4-inch hose from the fire-plug on the avenue.

The time occupied in filling the tank was less than a minute, and during this operation the outlet to feed the pump was closed.

The volume of steam accounted for by the indicator has been ascertained as follows: The capacity of the cylinder at the instant of release was found by adding to the stroke (30 inches), the waste-room (1.23 inches), and subtracting the distance from the termination at which the exhaust port was opened (2.5 inches), giving a length of 28.73 inches. The engine was credited for each stroke with this volume of steam at the terminal pressure (14.445 pounds). It was then charged with the steam confined at the closing of the exhaust, which filled a length of (2+1.23) 3.23 inches, at a density of 15.8 pounds.

The calculation made on this basis gives a consumption per hour of 43,963 cubic feet of steam at the pressure of 14.345 lbs. This volume, multiplied by the decimal .0358, the weight, in decimals of a pound, of one cubic foot of steam at that pressure, gives 1,573.87 lbs. of water accounted for per hour, or 92.36 per cent. of the water evaporated.

It was made impossible for any water to enter the boiler, except that drawn from the tank, and all the steam generated, except that taken by the feed pump, as hereafter mentioned, was worked through the engine.

The engine was run continuously for 11 hours, from 11 A. M. to 10 P. M., with two interruptions.

The first was at 2:30 P. M., for putting on a belt, and lasted only two minutes; the second was at 6 o'clock, to permit an exhibitor to make some connections, and was protracted to twenty minutes. It was not expected, however, to be more than momentary, and we were hoping every minute to start again. The boiler was not thought of until it was heard blowing off with a pressure in the pipe of over 100 lbs., making it necessary to open also the ¾-inch drain pipe from the main steam pipe. The exhibitors claimed that the loss of steam was certainly quite as much as the engine would have used if running, and as I found that the tank then emptying lasted a shorter time by three minutes than the next one did, I have thought it right to allow the claim. No account of stoppages is, therefore, made.

No counter was employed, but the engine was timed occasionally, and was always at its full speed of 125 revolutions; if inexact at all, it was in excess of this speed.

A barometer was not used, the pressure of the atmosphere is assumed at 30.154 inches of mercury, or 14.8 lbs. on the square inch.

The boiler had been supplied by a steam pump. For this trial, arrangements were made to feed it by a pump driven from the shaft, so that all the water sent into the boiler would be worked through the engine, as it was on trials last year. Unluckily, this pump gave out entirely on the morning of the trial, and the steam had to be used all day. No allowance is attempted to be made for this waste, but it seems proper to mention the fact that the engine worked under this slight disadvantage.

An important feature of this trial was the employment of steam slightly superheated. The mean temperature of the steam in the chest was 24.14° greater than that due to the pressure, and this chamber, extending the entire length of the cylinder, and around more than one-fourth of its circumference, acted also as a steam jacket, and one in which no condensation could take place.

It is interesting and highly instructive to note, in the tables, how, as the degree of superheating was raised, and at the same time a greater weight of steam was admitted to the cylinder, the percentage of the water accounted for by the indicator increased, and the economy, shown by the time required to empty the tank, was improved.

SECOND TRIAL.

For the purpose of this trial, a friction brake was fitted to the band wheel of the engine, which was very suitable for this use, being 9 feet in diameter by 26 inches width of face.

Each 1 lb. sustained at the brake represented 4107 foot pounds of work done per minute. Each 8.035 lbs. sustained required the exertion of one-horse power.

Each 30.6 lbs. sustained counterbalanced 1 lb. of mean pressure in the cylinder.

For the purpose of making the experiments more satisfactory, and of a character to expose their own errors or verify their own accuracy, five different weights were lifted, of 143 lbs., 374 lbs., 600 lbs., 800.5 lbs., and 1031.5 lbs. respectively. The first consisted of that portion of the weight of the apparatus itself which preponderated on the rising side, and which was carefully ascertained.

A number of diagrams were taken on each of the five trials, and the pencil was allowed to pass over each diagram from twenty to thirty times. The trials on the 18th were only partial, and must be regarded as preliminary.

The diagrams were taken equally from each end of the cylinder, except the seventh one on the fifth trial. Those from the opposite ends were nearly, but not precisely, equal, which accounts for the more extreme differences appearing in the tables.

On each trial the diagrams from the same end ran nearly identical, although the relation between the pressures exerted on the opposite sides of the piston varied somewhat at different points of cut-off.

The diagrams do not show an equal proportional loss from friction, but are given as they are. By comparing the diagrams on the first and fifth trials, the increase of friction caused by the load is seen to be 3.5 per cent. That is, the difference between the diagrams exceeds, by this percentage, the difference between the weights sustained.

At the conclusion of the trial, the band was removed from the wheel, and the engine was run for the purpose of obtaining the fractional diagrams, with the result given in the tables.

Steam was supplied on this trial, as on the first one, by the Allen boiler, having 900 square feet of heating surface, of which 730 feet were below the water line, and 170 feet were above it. Steam was easily kept up while the engine was exerting 141.68 horse-powers.

To test the power of the engine, the steam-pressure was run down below 60 lbs., and diagrams were taken, with an initial pressure of from 53 to 56 lbs., cutting off at .45 of the stroke, and developing 141.68 indicated horse-powers. The pressure was then raised to 90 lbs., and diagrams were taken with an initial pressure of 85 lbs., cutting off at .23 of the stroke, and developing the same power.

The following tables are those given in the report, except that we have been compelled in some instances to reduce them to a mere statement of the average results obtained.

TABLE 1.—THE WATER EVAPORATED.

The water tank was emptied twelve times.

Time required to Empty the Tanks.	Weight of Water furnished to Tank.	Weight of Water which the Diagrams account for.	Per centage of the Water accounted for.
Hours.	Lbs.	Lbs.	Per cent.
11	18,750	17,304.7	92.29

The twelfth tank was emptied a few minutes before ten o'clock, but the water was then too high in the boiler, and when—at ten o'clock—the engine was stopped, it had been reduced to the precise mark at which it stood at the start. About one-seventh of the water accounted for by the indicator during the last 65 minutes was derived from preceding tanks.

TABLE No. 2.

Capacity of Tank, in cubic feet	25.
Weight of one cubic foot of water, (lbs.)	62.5
Pounds of water evaporated	18,750.
Pounds of water evaporated per hour	1,704.5
Pounds of coal burned per hour	189.4
Mean pressure in the cylinder, above that required to neutralize the counter pressure (lbs. on the square inch)	17.345
Horse powers exerted for each 1 lb. of mean pressure	3.808
Effective indicated power (horse powers)	66.05

* The evaporative duty of the boiler was in reality greater than this.

Coal burned per hour for each effective indicated horse power (lbs.)	2.868
Pressure of the atmosphere in lbs. on the square inch (assumed)	14.8
Mean back pressure above that of the atmosphere in lbs. on the square inch	.983
Total mean pressure in cylinder, in lbs. on the square inch	33.128
Total work done by steam in cylinder (horse powers)	126.15
Coal burned per hour for each gross horse power (lbs.)	1.5
Proportion of work done by the steam that is reckoned as effective	.5236

TABLE No. 3.

To show the cost of the indicated horse-power of the engine.

	Pressure in the Steam Pipe, by Gauge.	Temperature of Steam in Chest.	Degrees of Superheat.	Initial pressure.	Proportion of Stroke at which the Steam was cut off	Mean Pressure.	Terminal Pressure.	Theoretical Terminal Pressure.	Excess of Ter. Pres. above Theoretical.	Average Back Pres. above Atmosphere. (Indep't of Cushion.)
	Lbs.	Deg.	Deg.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs	Lbs.
A	72.975	343.9	24.14	69.965	.11	17.345	—.455	—2.085	1.63	.983
B	73.25	344.	23.88	71.1	.1	16.33	—0.51	—2.57	2.06	1.03

The figures given in the upper line (A) are from diagrams taken from the forward end of the cylinder, and those in the lower line (B) from the back end.

TABLE 4 (A).—WORK DONE AT THE BRAKE.

	1st Trial	2d Trial.	3d Trial.	4th Trial	5th Trial
Weight sustained.	143 lbs.	374 lbs.	605 lbs.	800.5 lbs.	1031.5 lbs
Foot pounds of Work done per Minute	587,301	1,536,018	2,484,735	3,287,653	4,236,370
Horse Powers developed	17.797	46.546	75.295	99.624	128,375
Lbs. of Mean Pressure in Cylinder required to be in Equilibrium	4.673	12.222	19.771	26.16	33.71

TABLE 4 (B).—POWER EXERTED IN THE CYLINDER.

	Pounds of Mean Pressure.				
General Average	7.14	14.76	21.97	28.55	37.207
Horse Powers exerted	27.19	56.2	83.66	108.72	141.68
Percentage of useful effect	65.45	82.8	90.	91.62	90.6

	Forward End of Cylinder.		Back End of Cylinder.		
Frictional Di'grms	No. 1.	No. 2.	No. 3.	No. 4.	Average
Mean Pressure	2.225 lbs.	2.2 lbs.	2.175 lbs.	2.1 lbs.	2.175 lbs

The Mean Back Pressure above the Atmosphere Averaged .5 lb.

TABLE 5.—COMPARISON OF THE RESULTS WITH THOSE OBTAINED LAST YEAR.

	Allen.	Corliss.	Babcock and Wilcox.
Diameter of Cylinder (inches)	16.	16.13	16.
Area of Cylinder (square inches)	201.06	204.25	201.06
Length of stroke (inches)	30.	42.	42.
Waste room adds to stroke inches.	1.23	1.3	.63
Revolutions per minute	125.	60.344	60.273
Feet travelled by piston per minute	625.	422.4	421.9
Cubic feet displaced by piston per hour	52,344.	37,014.	35,900.
Pressure of steam in pipe (lbs.)	72.975	80.51	81.69
Initial pressure in Cylinder (lbs.)	69.965	70.943	76.148
Proportion of stroke at which steam is cut off	.11	.226	.189
Effective mean pressure (lbs.)	17.345	29.728	31.057
Effective horse powers exerted	66.05	76.579	78.792
Counter pressure above atmosphere (lbs.), see note 2	.5	.68	.8
Pressure of the atmosphere (lbs.)	14.8 (a'ssd)	14.8	15.043
Total mean pressure (lbs.)	33.128	45.208	46.9
Gross horse powers exerted	126.15	116.456	118.985
Proportion of total work done by steam in cylinder, that is reckoned as effective	.5236	.6622	.6575
Pressure at termination of stroke, relatively to that of the atmosphere (lbs.)	—.455	+5.178	+3.055
Total pressure at termination of stroke (lbs.)	14.345	20.	18.1
Weight of one cubic foot of saturated steam, at the terminal pressure (lbs.)	.0358	.0487	.0447
Pounds of water evaporated per hour	1,704 5	1,995.547	2,007.746
Pounds of steam per hour, *by indicator*	1,573.87	1,815.723	1,595.496
Percentage of water accounted for by the indicator	92.36	90.99	79.47
Number of times the volume of steam is multiplied by expansion	6.3	4.3	5.
Ratio of gain by expansion	2.3	2.25	2.6
Pounds of coal per hour for each effective horse power	2.868	2.895	2.831
Pounds of coal per hour for each gross horse power	1.5	1.9	1.87
Percentage of indicated power that was usefully exerted	91.11	90.23	87.2

From the foregoing tables it will be noticed:

I. The theoretical terminal pressure was ascertained by calculation from a point on the expansion curve after it was certain that the steam had been cut off—a method that insures accuracy.

II. During the friction brake experiments, when the steam was discharged under some pressure, the back pressure was observed to be much less than during the trials for economy. This was doubtless owing to the fact that in the former case the large body of steam in the exhaust pipe was put in motion at high velocity by the pressure at the instant of release, while in the latter it was inert, and so resisted the motion of the piston.

The difference was very marked, and when the steam was released at from 3 lbs. to 6 lbs. pressure, the back pressure could not be judged to exceed .5 of a pound. In comparing the results with those of last year, when the steam was released at about this pressure, the latter decimal must therefore be used.

III. The Allen Engine Works had requested that the engine should be loaded for the trial to the extent of at least 100 horse powers, in order that the mean effective pressure in the cylinder should be as great, or nearly so, as it was in the engines tried last year. Efforts were made to provide this amount of resistance, but with very poor success. The diagrams show only 66.05 horse powers exerted, requiring a mean effective pressure of only 17.345 lbs. against 29.728 in the Corliss, and 31.057 lbs. in the Babcock & Wilcox Engine. No just comparison for economy can, therefore, be made, except by measuring the total work done by the steam in the cylinder in each case, for, if the work done in overcoming the atmospheric resistance were deducted alike in all the engines, then we would have only 52.36 per cent. of the total work done allowed to the Allen Engine, and an average of 66 per cent. allowed to its competitors, as effective power, while in truth the work of the steam in overcoming the pressure of the atmosphere is precisely the same as if the resistance overcome was that of a pump or a saw mill. To illustrate this by a more extreme case, let the mean effective pressure be only 5 lbs., making, with the atmosphere, a total pressure of 20 lbs., and let the coal burned be, as in this case, 1.5 lbs. per hour for each gross horse power. Now, if the atmosphere is deducted, the consumption for each effective horse power will be 6 lbs. per hour.

It is obvious that when the pressures differ so widely as in the present case, a comparison made after deducting the atmosphere would give a very erroneous result.

The coal burned for the Allen Engine, divided by 52.36 per cent. of the power exerted by the steam, gives a quotient that is just the mean of those obtained by dividing the coal burned for the Corliss and the Babcock & Wilcox Engines by 66 per cent. of the power exerted in them; and the coal burned in each case, divided by the total power exerted, shows a consumption, for the Allen Engine of 1.5 lbs. per horse power per hour, against a consumption of 1.87 lbs. for the Babcock & Wilcox Engine, and of 1.9 lbs. for the Corliss Engine.

This economy is believed to be without precedent, except in cases where steam has been expanded in two or more cylinders, and reheated on the passage.

IV. The ratio of gain by expansion is ascertained by dividing the mean pressure through the stroke, which represents the work done, by the pressure at the termination of the stroke, which represents the steam consumed in doing it.

The gain of 2.3 by expansion shown in the Allen Engine is perfectly correct, and consistent with the theoretical tables, as will appear, because, first, these tables make no account of waste room, and second, the terminal pressure or divisor is, on the diagrams, higher than the theoretical expansion calls for. In order to find both the point of cut-off and the mean pressure for any comparison of the diagram with the requirements of theory, the waste room must be regarded as forming a part of the piston displacement. In this case the steam was expanded to 6.3 times only, instead of 9 times its original volume.

It cannot be contended that the superior economy of the Allen Engine is due to its working more expansively, as its gain from expansion was not materially different from that of the other engines.

V. At each stroke of the piston, 16,651.8 foot pounds of work were done in the cylinder, involving a loss of 21.57 units of heat, or heat sufficient to raise the temperature of 1 lb. of water 21.57°. The weight of steam which entered the cylinder was .1136 of a pound, and it contained 138.8 units of heat. Of the 21.57 units of heat lost during the stroke, 9.38 units were lost before the closing of the port, and might have been restored directly from the boiler. The remainder, 12.19 units, were converted into work during the expansion. Of this amount, 2.78 units were supplied from heat set free by the expansion, leaving 9.41 units, which, if no other source of heat existed, must have been supplied by the condensation of nearly one-thirteenth part of the steam. But about one-half of the cylinder walls had a temperature equal to that of the steam in the chest, or 132° greater than that of the steam when expanded to the atmospheric pressure, and this surface was sufficient, at the rapid reciprocation employed, to impart to the steam, during its expansion, a very considerable amount of heat, and in this manner, without doubt, the heat converted into work was so far restored to the steam as to cause the indicator to account for the very large per centage of the water evaporated that is shown in Table 1.

VI. In stating the power given off by the Allen Engine, in comparison with that given off by the Corliss & Babcock and Wilcox Engines, it is necessary to have regard to the mean pressures exerted.

The mean effective pressure exerted in the latter engines averaged about 30 lbs. on the square inch of piston.

During one of the experiments with the friction brake, the mean effective pressure in the Allen Engine was 28.55 lbs., and during another it was 37.207 lbs. It seems fair to take the mean of these two as the comparative duty of this engine, which is thus fixed at 91.11 per cent. of the indicated power.

Finally, the performance of the Allen Engine, it will be seen, exceeded that of the engines tried last year, both in its economy and is the proportion of its indicated power that was given off in useful effect, and also, what its high speed renders especially remarkable, in the proportion of the steam pressure in the pipe that was realized in the cylinder, and in the absence of back pressure. It ran also through the Fair, and on many of the days for 11 and 12 hours successively, without ever having a warm bearing.

The report is followed by the endorsement of the Judges, Messrs. BARNARD, SLOAN and WEIR, who witnessed the performances of the engine.

Polytechnic Club of the American Institute.

Meeting held at the rooms of the Association, March 9, 1871. The President (Prof. S. D. TILLMAN) in the chair.

STEAM CARS FOR CITIES.

Mr. J. K. FISHER exhibited a drawing of a steam carriage, intended to run upon rails in cities. There is a pair of pilot wheels, running in grooves, and the remaining wheels are made about five inches in width, to run upon the track. He requested the opinion of engineers, whether upon an ordinary straight track these wheels would follow the pilot wheels and remain upon the track, or if they should occasionally run off, whether they would be drawn by the pilot wheels on to the track again. On curves it is intended that the following wheels shall run off the track.

Mr. ROBERT WEIR—I think the rear wheels will be running off and on all the time. There must be some swinging all the time in the motion, and unless there are flanges, I think they would be likely to be off the rails quite as much as on. Yet I would like to see it tried before saying positively.

Mr. ———If one rail should be higher than the other, the rear wheels would be sure to slide sideways. Rails are more often uneven than even.

The PRESIDENT—If you have four pilot wheels instead of two, it will keep them on the track.

Mr. WEIR—You could keep them on by having a pilot at both ends.

Two GENTLEMEN expressed the opinion that the wheels would follow the pilot wheels.

Mr. C. O. READ—I think they will follow the pilot wheels when there is nothing to throw them off; when there is no obstruction.

The PRESIDENT—If you have only one pair of guiding wheels, any obstruction on one side will tend to throw to the other side the point connected with the rear wheels. It will require two pairs of guiding wheels to keep that point fixed. Early in the history of railways the cars were not placed upon trucks, two pairs of wheels to each truck; and Mr. WINANS, of Baltimore, took out a patent for putting long cars upon trucks. That was found to work admirably, and the patent would have been worth millions if it had been sustained by the courts. But it was decided that he was not the first inventor. On the palace cars, there is at each end a truck having three pairs of wheels.

Mr. FISHER.—Did you ever know a case when the hind wheels of a wagon did not follow the forward wheels?

Dr. EDWIN MCCRACKEN—The driving wheels of a locomotive are made flat, and they follow the guiding wheels.

Dr. VAN DER WEYDE—In front of a Harlem railroad engine house used to be a curve where they had extra rails to support the driving wheels of the locomotive, which were flat, without flanges, and ran there entirely outside the track.

Dr. MCCRACKEN—I think those wheels would follow right along if there were no impediment in the way.

The PRESIDENT—True; if there were no impediment.

Mr. FISHER—For the next ten years it is better that we should run on the pavements and on the street rails by steam, than that we should go to the expense of laying rails. These carriages are intended to run on the ordinary street rails; but when there is any obstruction, as in the case of a fire, they can run off the track, and if necessary run around a block. There should be two classes of carriages, one very cheap, in which people should stand up as they do now, and another at a higher fare in which every one should always have a seat. We can run eight and a half miles an hour with steam as safety as we can run six miles an hour with horse power. The whole power of the steam can instantly be applied to stop the cars when necessary. The steam cars could run up the steep grades as rapidly as the law allows, which cannot be done by horses.

Mr. WEIR—Have you made any estimate of the cost of a carriage like that?

Mr. FISHER—The Novelty Works offered, before the war, to build them for $4,500 apiece.

Mr. WEIR—How does the weight compare with that of the horse cars?

Mr. FISHER—They would be heavier, by the weight of the machinery and of the portion of the carriage which carries the machinery. For an equal load they would perhaps weigh one quarter more.

Mr. ———Why were the steam engines taken off the Second Avenue road?

Mr. FISHER—The engines were not properly constructed, and they were too heavy for the track.

Mr. DISTURNELL—Have not engines of this kind been before the English public for thirty or forty years? Have they made any improvements in them, or brought them into use?

Mr. FISHER—There are probably 1200 of AVELING and PORTER's and other's road locomotives at work there to-day for slow transport.

Mr. DISTURNELL—In a library in Philadelphia, I saw the other

day an old volume containing a plan very nearly like this; and all these arguments were made thirty or forty years ago. We have heard Mr. FISHER's arguments for the last twenty years. I cannot see that we are making an iota of advance.

M. FISHER—The law of road-locomotives in England is that their speed shall not exceed two miles an hour in city, and five miles in the country. There are other than mechanical reasons why they have not been more extensively used in England. Mr. F. proceeded to describe improvements in construction which had lately been made, such as the introduction of the link, the use of easy springs, etc.

ELECTRIC TIMEKEEPING.

Dr. S. BRADLEY read the following paper:

Electric timekeeping is a subject which, for the last quarter of a century, has engaged the attention of many profoundly scientific men, among a host of whom I may name, especially, SHEPHERD, BAIN, DENT, AIRY and WHEATSTONE. Much time, labor and money have been expended in efforts, not only to produce primary regulators, to be actuated by electric force, but to devise modes of telegraphing time through lines of secondary dials, by electric impulses sent through the line from a galvanic battery, contacts being automatically established and interrupted by some device in the primary regulator, by which they are caused to move synchronously with it.

I may say that all such efforts have hitherto proved ineffectual. All prime movers have been found to vary more or less, according to the ever varying condition and strength of the moving force. Every change in the condition of the battery elements, as well as in the temperature, changes the power of the battery in some degree, and every change in that power changes the rate of the timekeeper moved by it.

A more serious difficulty has been encountered in the employment of oscillating or ticking clocks for opening and closing circuits of secondary dials. Anything short of substantial and firm closings are liable either to fail of contact, or to make double or triple touches, and are therefore unreliable. No oscillating pendulum can be made to move with power sufficient to overcome the resistance offered by such firm closings. Contacts in mercury do not answer, for the reason that the metallic points dipping into it soon become coated with an insulating film, causing failure. Even firm contacts by single platinum points are liable to fail, on account of the corroding effect of the spark usually visible on breaking circuit.

In the system which I have the honor here to present, all the aforementioned difficulties are avoided; modes entirely new are so combined and arranged as to present a complete whole, capable of fulfilling the object so long sought.

The primary regulator is moved by a weight, which is undeniably the most uniform and persistent propelling power of any. The conical or gyral pendulum (mercurially compensated) is employed, in which there is a constant store of force, acting as a retaining power, amply sufficient for overcoming all necessary resistance in firmly closing circuit and for carrying the movement forward while winding the clock. Instead of a single platinum point for closing circuit, two or more are used. I employ four, placed on four springs, all closing at the same instant, on a horizontal platinum bar. The current being thus divided among them, the quantity for each is so small that no corroding spark is visible.

An arm on the second-hand shaft of the primary at every revolution tips a lever, which brings the platinum points of the springs in contact with the platinum bar, which closes circuit through the line of secondaries. In each secondary an electro-magnet is so actuated as to carry forward, by means of pawls, a sixty-toothed wheel, which carries the minute-hand shaft, the wheel being moved one tooth at each closing; the minute-hand, therefore, performs one revolution every hour, and the hour-hand is carried by the ordinary arrangement of face wheels.

The circuit being thus closed only once every minute, and then only for a second or two at a time, the expenditure of battery power is limited to that of, say one-thirtieth the amount supervening where circuit is closed every second.

This system has been in operation in Wall, Broad and New streets, New York, for about six months; a primary at the brokers' board room and some fifteen secondaries in as many brokers' offices; and, with the exception of a few mishaps, such as are incidental to the development and first introduction of all new inventions, it has run with perfect regularity, and has given entire satisfaction to all concerned.

Dr. BRADLEY also exhibited his primary clock, with a secondary dial. Ordinarily, in sulphate of copper batteries the liquid rises by capillary attraction on the interior surface of the glass cell, and then dries and crystalizes. By pouring a film of oil on the top of the liquid the cell may be kept for months clean and free from crystallization.

Dr. —— stated that the top of the jars had sometimes been oiled for the same purpose.

Dr. BRADLEY, describing the gyral pendulum, stated that it possessed a store of force, so that in winding the clock, even if a whole minute should be occupied, there would be not a second of time lost. The pendulum has a mercurial compensation. In ordinary mercurial compensation pendulums the column of mercury is not long enough.

Dr. VAN DER WEYDE stated that the height of mercury necessary for compensation could be computed with accuracy, and referred to a clock for which he had computed the amount of mercury required, and which has since run twenty years without changing.

Dr. BRADLEY remarked that he had observed that when there was weight enough applied to make the pendulum swing in a large circle the clock ran faster than when it was swinging in a small circle.

Dr. VAN DER WEYDE—I am surprised at that; for in a common clock it is the other way. If you give the oscillations of a vibrating pendulum greater amplitude the clock goes slower.

Dr. BRADLEY—It surprised me; but I found it to be so.

The PRESIDENT silently drew upon the black-board a representation of the pendulum at two different distances from the centre, showing that when revolving in a large circle it is vertically shorter.

Dr. VAN DER WEYDE—I think the cause is, that the greater power required to make the pendulum deviate so far from the axis of gyration overbalances the tendency it would otherwise have to go slower. You will remember the experiments of FOUCAULT to demonstrate the rotation of the earth by means of a very long pendulum. That pendulum has a great tendency to go into a gyration. When it describes an ellipse that ellipse will shift its position, owing to the rotation of the earth. I found in experimenting with it that it could be made to go in a circle. That pendulum would go slower in a large circle than in a small circle. But in this case it is not a constant power that drives it. You add to the power, driving it farther from the centre; as the power is increased the circle is larger; and if the power were infinite the pendulum would rotate in a horizontal plane. But the power is increased in a greater ratio than the size of the circle, and therefore I see that it must go faster.

Mr. FISHER—The question of centrifugal force must have something to do with the phenomenon. I think the solution is in that.

Dr. VAN DER WEYDE—It may be interesting to state how HUGGENS corrected the tendency of a vibrating pendulum to require more time to go through a large arc than a small oscillation. If it will vibrate in a small arc 60 times in a minute, it will vibrate only 58 or 59 times if the arc is greater. The pendulum will move faster in the larger arc, but not in proportion to the space through which it has to pass. HUGGENS discovered the line of equal descent. A pendulum swings by the same force and in the same time that a ball would roll upon a circular arc. A ball rolling down the line of a circular arc will reach lowest part later when started at a greater distance from this point. But if two balls were placed upon the curve of equal descent, at different distances from the center, they would reach the centre together. That line of equal descent HUGGINS found to be a cycloid; the curve of which would be described by a nail in the rim of a wheel moving over the ground. In order to make the pendulum move in that curve HUGGINS ascertained the form of the evolutic cycloid, and placed at the top of the pendulum cycloidal cheeks of that form.

The PRESIDENT—The spring by which the pendulum rod is supported, by its bending, attains nearly the same end in a very cheap way.

Mr. ALEXANDER DECKERS described and represented upon the black-board a pendulum which could be made to move so slowly that a clock with a pendulum a foot in length would require but one wheel. It consisted of a fly-wheel rolling upon a vertical cone, and suspended from the top.

Dr. VAN DER WEYDE explained the principle of the pendulum used for the metronome, in which, by means of a counterpoise above the centre of gyration, a pendulum a few inches in length may be made to vibrate as slowly as once in two seconds.

ALTERNATING BATTERY.

Dr. EDWIN MCCRACKEN exhibited his alternating battery, which consists of two batteries, so connected with a clock movement that at certain intervals they are alternately brought into action, and explained the principles upon which it is founded. He said:

This invention is for the purpose of alternating the batteries. I discovered that electricity wanted rest. It is strange, but nevertheless a fact. I took two equal zincs, in batteries charged with the black oxyd of manganese and either common salt or sal ammonia, and one was kept in operation, and died in 32 minutes, while the other, which was allowed to rest one half the time, shows to-night 3° better deflection than when I started it on the 10th of last November. In the latter case the battery was allowed to rest every five minutes by an instrument like this, which is nothing more than an ordinary Yankee clock, with a circuit maker and breaker of ivory and brass. By this the circuit is changed from one battery to the other without being broken for an instant. We change from battery No. 1 to battery No. 2 so exactly that even so delicate an instrument as the galvanometer will not know when it happens, except that it swings up two or three degrees that it loses in that time. I was led to the discovery by this circumstance. I had in my house a sounder, and I had left the key open. At night I found I had no circuit. My wife, in dusting, probably hit the circuit breaker with her brush and closed it. I left the key open, and the next morning I did not intend to touch it, but by accident my overcoat struck the key and it sounded at once. This led me to the investigation how that current was produced, and I found it was from resting the battery. By changing every five minutes I found I could keep up a continuous circuit. It is like carrying a load. A man could not take 100 lbs. on his shoulder and carry it far; but two men could carry it to Harlem by shifting it from one to the other. Dr. BRADLEY spoke of making a double connection; having four springs in his clock connecting at the same moment. I cannot see why there is any difficulty about one sure connection. If it is made right and set right one is just as good as a hundred, and the instrument cannot be burned by the electric current. I have used this battery for an electric light, which has been in operation every night for ten consecutive months, using 982 lbs. of zinc. MOSES G. FARMER states that at an expense of $1 42 we produce 450 candle power, burning a fourth of an inch of solid carbon. Dr. McC. proceeded to explain how the products of the battery could be utilized. Bichromate of potash costs 16 cents per pound, and sulphuric acid 2½ cents. Sulphate of chromium costs a little less than 2 cents per lb. The chrome alum which is produced from the products of this battery is worth 60 cents per lb. It is used as a dye in calico printing, and is next to aniline in color. The carbonate of zinc is worth 13 cents per lb. Then the amalgam may be placed in a jar with sulphuric acid diluted by adding four parts of water to one of the acid, and the zinc will be dissolved and the quicksilver precipitated in metallic form, If the products of the battery are not thrown away the battery will support itself minus the labor. Chemistry tells us that nature wastes nothing, and we ought not to waste it.

Dr. VAN DER WEYDE—How do you manage at the very moment of change? Are both batteries on?

Dr. MCCRAKEN—There is a time when both batteries are on at once; but it is very short.

Dr. VAN DER WEYDE—Do you find any difference from changing in a longer or shorter time than five minutes?

Dr. MCCRAKEN—Yes, sir; there is this difference, that if a man carries a load until he is tired it takes longer to recover.

Dr. VAN DER WEYDE—Do different batteries require different times?

Dr. MCCRAKEN—Every battery requires its time. Some batteries, as the Smee battery, will run as long as fifteen minutes; but you cannot run a light with the bichromate of potash battery without changing every five minutes. There you have to change oftener because it is a battery of intensity. My battery stood 50 to 1. Coupled together, it was quantity 2 and intensity 100. As the circuit changed the light did not waver, but always increased and came up with the new fresh battery, showing that it was rested.

Dr. VAN DER WEYDE—The chromic acid battery was introduced, I believe, about the year 1863. At that time I had a large carbon battery of 12 cups, in which I used nitric acid. I at once changed, and tried the chromate of potash and sulphuric acid. I was astonished that the battery ran down so quickly. It did not last more than five minutes in full power; but I found that on allowing it to rest, it soon recuperated. I then made experiments comparing the recuperating power of this battery with that of the Bunsen battery. I filled six cups with nitric acid and the other six with bichromate of potash and sulphuric acid. I found that in about an hour this battery was exhausted, while the Grove battery lasted much longer. There was no battery existing that ran down so quickly as that with the bichromate of potash. The battery wanted rest; and the next question was, why it wanted rest. I found upon examination that the chrome alum was crystallizing in the pores of the carbon and choking them up, while the battery was in use, but when I let the battery rest it was dissolved again. When I took the carbon out, while it was allowed to rest, it did not do so much good, for the simple reason that it did not dissolve. But when I left the carbon in the liquid, and let the battery rest for five minutes, the battery was recuperated to its former power. I afterwards published these facts in the *Journal of Applied Chemistry*.

Other batteries do not need rest so much, but they all need it; and it was a very happy thought of Dr. MCCRAKEN to make the change by clockwork, and have no doubt it will prove valuable.

Dr. MCCRAKEN—This is the first time that I have heard any gentleman state that the idea of a rest being required had occurred to him. But I cannot agree with the opinion as to what takes place during the rest. I have alternated it in three minutes, and the chrome alum would collect in spite of me. I will tell you my theory. We have two poles, positive and negative. We have oxygen and hydrogen gases passing, and as they meet one another they produce a wall of water which protects the zinc from the acid. The moment you break the circuit the water begins to disappear, and the battery is soon ready to set again. The water, which is between the porous cup and the chromic acid, absorbs the electricity which is generated, when this battery has been in action long enough to require rest.

Dr. VAN DER WEYDE—Then you mean that the layer of water would be an obstruction to the current?

Dr. MCCRAKEN—Yes, sir.

Dr. VAN DER WEYDE—And that the formation of chrome alum in the pores of the carbon has nothing to do with it?

Dr. MCCRAKEN—No; I would not say that; because it might have some effect.

Dr. VAN DER WEYDE explained by formulæ the chemical decomposition and recomposition caused by the current of this battery, showing that it was true that water was formed along the porous cup, and possible that this layer of water might be one of the causes of the running down of all batteries, but does not account for the fact that the so-called chromic acid battery runs down more rapidly than any other.

Mining in Humboldt County, Nevada.

UNIONVILLE, March 7, 1871.

TO THE EDITOR: Sir—In Buena Vista Mining District, in which this town is situated, the hope of general and greater activity in mining is confirmed by the preparations with the approach of spring. The three mills have kept at work all winter. The Silver Mining Company's mill and the Arizona mill have been running on Arizona ore, of which a stock had accumulated at each mill before the winter set in. The Pioneer, after having been idle a few weeks to repair the water wheel, has been running on North Star rock a few days, and then on old tailings, on account of the scarcity of water in the creek. The Arizona mine has been worked regularly since the first of the year with a force of about twenty miners. Only the shipping rock is brought down, assorted and shipped to California. The North Star mine is worked by a force of about ten miners, taking out the lower grade rock for milling and the usual percentage of shipping ores. The ledge is yet irregular and broken, having been opened only a few feet from the surface. The Potosi tunnel is being run steadily by two men on contract. Three or four other claims wait for the fine

weather to set in, to be worked. It is understood that the force of miners will be increased in the Arizona and North Star mines as soon as regular hauling is practicable.

Central District is drawing considerable attention, there being three ledges now worked by the locators. These ledges are rich enough to pay the owners a profit by shipping the rock to Reno or San Francisco for reduction. It is expected that the Ruth mill at Rye Patch will soon commence working custom rock. This will be a great advantage to the mines in the vicinity, giving them a chance to work such ores as would be too poor to ship to Reno and elsewhere. The Aikin furnace connected with the mill, said to be an infringement on the STETEFELDT furnace, has been visited by the partner of Mr. STETEFELDT, who is reported to have brought the necessary papers to stop the work; but on examination he went away without serving them. Mr. AIKIN has been in town, and it is said that he is ready to build two kinds of furnaces for the public, one at great cost for those who want a durable one and another cheaper one of less durable material.

Star District will probably draw attention during the next summer. Both the Sheba and the De Soto have struck rich bodies of ore, and it is said that active operations will begin as soon as there is sufficient water in the cañon to start the stamps and concentrating machinery put up last fall. Mr. OSBESTON, the manager of the Reno mill, has visited the WHITMORE Co.'s claim, Sheba series, a claim owned by his company near the De Soto, and was so far pleased with the outcrop, as to induce him, it is reported, to contemplate active operations the coming season. Besides these there are other claims on which considerable work has been done, which are likely to resume work as soon as hopeful indications are found in the district.

In this district (Buena Vista), in Bloody Cañon two antimony ledges are worked, and about twenty tons have been shipped to San Francisco for sale. With a little more encouragement much gray antimony and copper ore would find their way to the markets of the world from many districts of this county. At Oreana all the smelting works have stopped work. Mr. TORREY, who has an undershot water wheel, on the Humboldt river, about three miles north of Oreana, with which he runs a few pans and the blast of a furnace, is yet at work trying to beneficiate the ores of district. He is trying to introduce the metal smelted out in his furnace as Babbit metal. It is said to have answered the purposes for which this metal is used, where tried; and as the component parts of his product the anitmony and lead are given as the principal parts, while silver and iron are present in very small quantities. D. V. S.

MINING SUMMARY.

Colorado.

The Georgetown *Miner*, March 9, discoursing on mining affairs, says: "As spring approaches, our mining affairs begin to assume a more cheerful aspect. A general belief prevails that smelting works will be built during the coming summer, and that a market for smelting ores will be opened up at home. The belief, also, that our mines will soon have railroad communication with the Plains is producing a favorable and beneficial influence. The Baker mill, which has been undergoing thorough repairs during the winter, will start up in a month or two. The International mill at Argentine will also commence operations by May or June. The subject of ore concentration has received a great deal of attention during the past year, and the results obtained have been of such a nature that one of our prominent mining companies will soon proceed to erect concentration works of considerable capacity to treat their low grade ores. This branch of industry, reducing many tons to a small compass of pure ore will, no doubt, add considerable to our ore production in the future. The system inaugurated by the Stewart Silver Reducing Company, of buying small lots of ores and paying promptly for the same, enables many miners of small means to work their mines at a remunerative profit. It is expected that several companies with a large amount of paid-up capital will commence mining on a large scale as soon as spring fairly opens. The outlook for the coming summer is encouraging."

WHAT THE MINES AND MILLS ARE DOING.

The Central City *Herald*, of March 4, says that there is a healthy and encouraging activity and productiveness among the mines of Gilpin county. More mines or mining claims are being worked by individual parties than any previous time for many years, and the lessees or owners are generally meeting with a fair degree of success, and in many instances obtaining rich returns. The gold shipments of the three Central banks for the month of February were larger than were those of the same months of any previous year, and show a handsome increase over any month since November, 1869. Among the mines which were worked but little or not at all one year ago, that are now yielding large quantities of rich paying quartz, are the Kansas, Fiske, Gregory, Second, Newfoundland, Sudeberg lodes, and others. Some half a dozen different parties are working claims on the Gregory Second on lease, which generally obtains a return of 7 ozs. of gold or $140 per cord from the stamp mills. Groze & Co. are working No. 1, South & Stevens No. 2. Lower down on the hill are Miller & Co., then Miller & Borum, and just above the gulch Lovitt & Co. A. Furnald is working the Devil's Grip lode on lease from Stevens & Co. Along the line of the Kansas lode a very active appearance is presented. Some ten claims are being worked. Bennett's shaft is down 155 feet. The last ore crushed paid 10½ ozs. in stamp mill. Pease has been working the Newfoundland lode, below East Nevada, very successfully during the past two months. About ten tons of selected ore were purchased by HILL at an average price of $110 per ton. A large quantity crushed in stamp mill has yielded from $60 to $140 per cord. The Roderick Dhu mine keeps 35 stamps at work at the New York mill. This ore at present gives from three to five ounces of gold to the cord. NAT YOUNG's property on the Sudeberg is yielding some very rich quartz. JOHN SCUDDER has returned from New York and is raising ore from the Prize. Lower down on the same lode BUCK & Co. are taking out large quantities of fine looking quartz.

HILL's works are treating about 16 tons of the higher grade ores daily, and consume about 25 cords of wood in the same length of time.

ROOT & QUEEN are meeting with good pay in their gulch mine near the toll gate. Six men are employed during the day and three at night. An ounce of gold per day is obtained to the man. Many large gold nuggets have been taken out, some weighing over 2½ ounces. They are drifting extensively on the bed rock of the creek. We don't see why more companies do not engage in the same business in this creek.

MATT HAYES and ED. SMITH have leased the Gunnell Gold Co's property on the Gunnell lode, and are preparing to work at once. How long the remainder of this celebrated and valuable lode will remain idle, is impossible to tell.

CHURCH & BROTHER are having work done in the Burroughs National Company's 25 stamp mill East of WATERMAN'S, Nevada, and expect to be ready to start up in two weeks. This mill has lain idle for several years. WATERMAN will have his Kas-Colorado mill in operation soon on Kansas ore. The California rotary stamp mill on the Flag lode is not yet in operation. The Columbia lode, Nevada, owned by the TELLERS, is being worked in three or four places.

We herewith give the names of the largest gold producing mines (at this time) with the number of stamps kept in motion by each during the present week: RODERICK DHU employs 35 stamps; FISKE, 40; GREGORY SECOND, 30; KANSAS, 30; CALIFORNIA, 30; BURROUGHS, 30; PRIZE, 29.

Nearly all of the Black Hawk mills are running, and have a plentiful supply on hand. The amount of quartz crushed and of gold shipped is unusually large for this season of the year. At the Sensenderfer mill, (ROGER'S) 20 stamps are crushing Bob Tail ore; at LAKE'S 20 stamps are supplied from the Burroughs and Fisk lodes; while MILEY'S stamps and FITZPATRICK'S are kept constantly in motion on custom ores. MEAD is running 20 stamps on California ore from STALKER'S claim, and 15 stamps on BUCK & Co's Prize ore. LEWIS has leased and started up the Hurd (20 stamp) mill. The North Star mill (KIMBER & Co.) is running 32 stamps on custom ore from various lodes; among them the Sudeberg, Burroughs, Kansas, &c. MILLER & BORUM are supplied at the Empire mill with Gregory Second and Kansas quartz. J. S. FISHER is puddling the tailings at this mill with one of KECH'S machines with good results. The STEVENS 14 stamp mill is at work on Prize ore. The BLACK HAWK Co's mill is running its full complement of stamps, 20 on Burroughs and Smith, 20 on Fisk, and 25 on U. P. R., Gregory No. 1, Kent County and Boston quartz. The 20 stamp mill run by same company and machinery is supplied from the Dead Broke and Newfoundland lodes. The SMITH & PARMELEE mill (25 stamps) is run by FITZSIMMONS & COCHRAN on Kansas, Fisk and Gregory Second quartz. The New York mill is running 55 stamps on Roderick Dhu and other Nevada quartz. BOYLAN is running the DICKINSON mill on custom ores. Puddling is carried on extensively at most of these mills, the hands making from $3 to $5 per day.

WHITCOMB, HARDESTY, CLAYTON and POTTER are running their mills in Nevada, and WATERMAN'S Eureka mill is always at work.

THE GOLD SHIPMENT.

According to the Central City *Register* the following is the shipment of the three banks for the month of February:

	Currency.	Coin.
Thatcher, Standley & Co.	$66,000	$59,500
J. B. Chaffee & Co.	44,000	39,500
Rocky Mountain National	23,500	21,000
	$133,500	120,000

This compares as follows with the shipment of February for three previous years (coin):

1863	1869	1870	1871
$95,600	$85,800	$98,775	$120,000

The *Register* continues: This is the largest monthly shipment sent from this county since November, 1869—a period of fifteen months: the largest product of any one month of last year being that of July, which amounted to $118,700, coin. It should be noticed also that not one dollar of this February shipment was produced through the operations of any Eastern company, but all by the enterprise of individual miners, proprietors and lessees, and with the five largest mines of the country lying idle. At this rate we may reasonably look for a shipment of $200,000 per month during the summer.

Wyoming.

ITS COAL MINES—INTERESTING FACTS.

A Cheyenne correspondent of the New York *Evening Post* writes as follows of the coal mines of Wyoming:—In speaking of Evanston, we have touched upon what is becoming a prominent industry in Wyoming—we mean coal mining; and as the developments already made have a peculiar interest in the settlement of the New West, we will describe those in operation and speak of the recent discoveries. An analysis of the Evanston coal, which is perhaps the purest found in the territory, gives the following result:

Carbon	72.16
Ashes	2.50
Sulphur	None.
Water	3.34
Volatile Matter	22.00
Total	100.00

The Hallville mine, nearly three hundred miles from Cheyenne, is on Bitter creek, Carter county, Wyoming. It was discovered when grading the Union Pacific. There are two veins, with a stratum of soapstone between. The upper vein is ten feet and the lower six feet in thickness. The coal is used principally for domestic purposes, fifteen thousand tons having been used in Omaha the past year. The Vandyke mine, forty miles west of Hallville, was discovered in 1864, by an old mountaineer, who sold his claim in 1869 to the Hallville company for $25,000. The coal is used mainly for steam and blacksmithing purposes. Eighty thousand tons were sold in Omaha the past year, and the remainder was sent all over the western territories for manufacturing purposes. The Carbon mines, which were recently burned, are on the railroad, one hundred and forty miles west of Cheyenne. The coal is reached by a perpendicular shaft, seventy feet in depth. The vein is six to nine feet. Before the explosion it was producing three hundred tons per day, and was supplying the Denver division of the Kansas Pacific R. R. The Rock Spring mine, 315 miles west of Cheyenne, is an eight foot vein, reached by an open drift in the side of the hill. The product during 1870 was about 2000 tons per month. During December there were taken out and shipped nearly 2000 tons.

Explorations lately made show that the coal measures of Wyoming cover a very large area, and many of the best veins have not yet been worked. The lignite deposits of the Laramie plains, in beds of five to eleven feet thick, have been traced ten miles east of Rock Creek, a branch of Medicine Bow river, and crops out along the North Platte, Muddy Creek, Bitter Creek, Echo Cañon, Weber river, and west as far as the borders of Utah. The same deposits have been found eighty miles above Fore Laramie. The whole product of the Wyoming coal mines is now about 20,000 tons per month. The increasing demand for the coal, both for domestic purposes and for manufactures, must increase the product this year to more than double its present amount. The capacity of all the banks on the line of the Union Pacific can be multiplied many fold, and the supply seems inexhaustible. Prof. HAYDEN, U. S. Geologist, who a few weeks ago completed his examination of the mineral resources of Wyoming, gives as his opinion that in general heating properties, in freedom from sulphur, and in impressive resistance to atmospheric influence, Evanston coal will compare favorably with any in the market. It will make more steam than the same quantity of anthracite, and is better for gas generation than Pittsburg coal. It has less waste, showing a smaller proportion of ashes and clinkers. Experiments made in manufactures at Omaha show that it excels Lehigh coal for smelting, as it adds to the grain and toughness of the metal. From tests made in the motive department of the Union Pacific road it is found that a ton of Wyoming coal will propel an engine seventy-five miles, while the reports of the Pennsylvania Central show that a ton of anthracite will run an engine but forty miles.

Colorado.

THE GERMAN COLONY IN WET MOUNTAIN VALLEY—MINING.

A correspondent of the Central City *Register* writing from Colfax, Fremont county, February 20, thus speaks of the German colony and mining in Wet Mountain Valley: "The German colony is practically *non est*. Coming, as they did to this Territory, under the most favorable auspices, aided by the Government in the loan of tents, arms and equipments, and furnished transportation by railroads in the reduction of fares, by private individuals in the loan of money and unlimited credit, there is a degree of damnability connected with the early administration of their affairs that is inexpressible, even in a language so copious in expletives as the English. We do not pretend to say who is to blame, but we do say that had there been a man at the head of affairs who understood his business as a director and given his attention to the cultivation of the soil and seeding of crops, instead of erecting machinery that has proven to be utterly worthless, the sufferings of the colonists would have been greatly alleviated. In their present condition it requires a cool head and good financial ability, united with a firmness that knows no alternative, but a rigid adherence to the rules as they are given by the President, on the part of the colonists. If this course be followed, we do not doubt that Mr. Judd, the President, will restore order, and everything will go on smoothly and prosperously, inasmuch as they have every incentive to induce them to pitch in and make themselves homes in one of the most beautiful valleys in Southern Colorado. Another interest is springing up in this section, that will in a measure revolutionize the staid ways of the people of Fremont county. We allude to the time when Wet Mountain valley swings into line to the tune of hammer, drill and powder, making the old hills echo back the sound, as the miner is at work opening some of the finest and richest silver lodes we have seen. The ores are galena, zinc-blende and sulphurets. The veins are true fissure veins; at least they appear to be as far as the present development goes, crossing the stratas at right-angles to the country rock, gneissoid in its character. What a splendid field for mining! Coal within twenty-five miles, and a water-power that cannot be excelled in the world, and an easy country in which to build roads down Oak creek and Hardscrabble passes to the Arkansas valley, where we imagine that we see large reduction works, busy in smelting the precious ores. While in the mountains we met Dick Irwin, who has some very fine lodes. As a prospector, Dick has no superior in Colorado. His partner, Mr. Brown, is now engaged in developing the Eagle lode, that assays $30 per ton, at the grass roots. In a former letter we but casually mentioned Canon City, the metropolis of this county. Everybody appears to be busy. Buildings are going up and in process of completion, that would be a credit to any town in Colorado.

Montana.

MINING IN DEER LODGE COUNTY.

A correspondent of the Helena *Gazette*, writes from Deer Lodge, Feb. 17:—"Until recently the weather—except a few days in the latter part of December—has been very mild and dry, and unfavorable for a prosperous mining season, but on the 8th inst. we experienced quite a change, and with it a considerable fall of snow came to gladden our hearts and remind us of the fact (which we had almost forgotten) that the snow falls on the 'just' as well as the 'unjust.' No insinuation—we on this side know you are just on 'tother. Our mining community all have a broad grin upon their countenances, and report favorably of the different camps, feeling sanguine that the ensuing season will be a prosperous one. Our different ditch enterprises have been prosecuted with success during the winter, the mild weather being favorable to such work. The Miners' Ditch, from Race, is about completed to Prairie Gulch. Col. THORNTON & Co. are greatly improving their ditch from the same stream, by building reservoirs, which will greatly increase the quantity of water. These two ditches will open up an area of mines about five miles in length by two miles in width, which it is known by experience will pay from $5 to $15 per day to the hand; and it is confidently believed by old and experienced miners that future developments will make this camp equal, if not superior, to the banner camp in the Territory, Gold Creek. Messrs. HAYS, BATTERTON, and KOHRS are constructing a ditch from Warm Spring Creek to the Cable Hill, and thence to the Georgetown side of the mountains. This enterprise, it is admitted by all who know anything about the large deposits of quartz and the quantity of native gold in the surface formation, will richly reward the company. The Cable mine, under the management and superintendence of Mr. CAMERON, is a success—as proven by his weekly runs, of which the country have seen reports. The reports from Phillipsburg are encouraging. The mill there is being run by Captain PLAISTED, and if he does not make a success there, then indeed has her glory departed."

New Jersey.

The Newark *Advertiser* says: Over 600,000 tons of iron ore is mined yearly in Morris county, besides what is obtained from the adjoining counties. The average market price of this is $6 per ton, amounting to $3,000,000 per annum. The greatest portion of the ore is transported by rail to the Lehigh Valley, and there manufactured into pig and refined iron, ready for market use. The most famous mines of Morris county are those in the vicinity of Hibernia, Meriden, Mount Hope, Mine Hill and Chester. These are in one continuous range, following the strata of the granite rock, on a course northeast and southwest. Some of these mines have been worked since the Revolution, and are now in depth from 300 to 700 feet, and still hold their own at the bottom, the supply being apparently inexhaustible. Scarcely a mine in Morris county has proved a failure, but the owners have generally amassed fortunes, while in many other localities they have proved more or less uncertain.

MARKET REVIEW.

The Coal Trade.

NEW YORK, March 17, 1871.

The suspension in the various Coal regions continues in full force, and we hear of no efforts being made by either side toward a settlement. Indeed, the infection seems to be spreading to the Western bituminous coal region at Pittsburgh and vicinity. The avowed object in this new movement is to cut off the present supply to locomotives on the railroads leading from the coal districts, which are thus enabled to keep running on other kinds of freight than coal. The miners do not like this, hence the flank movement. We should think that by this time the operators and railroad companies were convinced of the utter impracticability of breaking up the Miners' and Laborers' Union. We gave the best of reasons two weeks ago why they (the miners and laborers) would be able to withstand the pressure and ultimately gain the day. Already we hear of assistance and sympathy offered to them by other trades' unions throughout the country. The New York Workingmen's Union of this city at a recent meeting passed resolutions in which they tended "the miners of the anthracite coal fields or mines of Pennsylvania their sympathy and support." This organization is one of the most wealthy and powerful in the country, and one which is alone able to keep from want the miners and laborers in the coal regions through their entire strike, if necessary. The W. B. A. does not, however, seem to be out of funds, and no call has as yet been made (as far as we can learn) upon the various other trades' Unions for assistance. Therefore, it appears to us that since the only hope of the railroad companies and operators in coercing the miners and laborers to terms, seems to be in starving them out. They will see the folly of their plan and give up the fight.

There are many other reasons why the breaking up of the Miners' Union is an impossibility, some of which we pointed out in our issue of two weeks ago; and it seems to us silly for members of the same family, whose interests are identical, to thus quarrel like a lot of children. We have previously remarked, that there is no great bitterness of feeling existing between the contending parties, and only a question of pride has prevented a settlement up to this time. The whole matter will finally be adjusted by arbitration, in which the dignity of neither party will be greatly compromised. Now, then, the sooner you get to work, gentlemen, the better. Much valuable time has already been lost. Immediately appoint a "High Commission," to settle the operators', miners', and laborers' claims, and put an end to the disastrous bickering and quarreling, which is of no benefit to either side, but, on the contrary, is greatly damaging innocent parties, and destroying those commercial and manufacturing interests of the country which depend on coal for their sustenance.

The "coal famine," which the daily papers threatened us with, has not as yet come upon us in all it horrors, if at all. There seems to be enough coal on hand, and these "modest" retail dealers, who, two months ago demanded from $12 to $14 per ton, are content with from $9 to $9 50. The opening of the Canals, in which were frozen up large quantities of coal, has enabled the wholesale dealers to restock themselves, while numerous parties in cities and towns adjacent to this city, who had overstocked last fall, are sending cargoes, and even single tons, to their neighbors to help them out. We hear that some cargoes have even been re-shipped to this city "on sale."

Plenty of coal can be purchased in the market to-day at from $8 50@$9 per ton. At these prices, we think if any of our readers are really in want of coal, it would be *safe to buy* in small quantities, for there will be another advance in prices shortly, unless there is some settlement of the present difficulties at an early day. The price of coal cannot go lower than $8 50@$9 00 for many months to come, while there is any probability of another panic and an advance.

Cumberland coals increase in favor with the consuming public as they are more generally introduced. The honorable manner in which the controlling interests in this extensive branch of coal industry have treated the public, is commended in every quarter.

Notwithstanding the high prices that anthracite coal has reached and the excitement accompanying the rise, the managers of the soft coal interest have strictly adhered to their old rates, and are offering in the market to-day coal at as low a figure as any time last summer, or any period during the past three years.

The best of the Cumberland coals—that of the Consolidation Coal Company—is offered at $7 75 alongside at New York, or $4 50 at Georgetown, D. C., $4 75 Baltimore, Md., per long ton.

Bituminous Coal Trade, 1870 and 1871.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending March. 11, 1871, compared with week ending March 12, 1870.

COMPANIES.	1870. Week.	1870. Year.	1871. Week.	1871. Year.
B. & O. R. R.	6,116	84,118	31,262	170,985
C. & O. Canal			5,932	5,932
H. & B. T. R. R.	6,427	40,998	7,196	49,022
Harrisburg & D.	9,149	95,142	15,016	90,[illegible]2
L. V. R. R.	3,310	3,310		5,484
P. & N.Y.C. & R. Co.	3,871	42,701	4,421	55,150
Total				

Anthracite Coal Trade for 1870 and 1871.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending March 11, 1871, compared with week ending March 12, 1870.

COMPANIES.	1870. WEEK.	1870. TOTAL.	1871. WEEK.	1871. TOTAL.
*Phila & Reading R. R.	5,511	548,870	12,442	592,713
†Schuylkill Canal	..	34,373	....	36,225
Lehigh Valley R. R.	35,335	631,390	10,398	346,829
Lehigh & Sus. R. R.	5,149	148,249	1,646	65,568
†Lehigh Canal	....	....	....	....
Scranton North	11,552	121,421	....	....
" South	32,084	307,8[illegible]	..	....
Penn. Coal Co., rail	17,650	172,545	247	3,008
" " canal	....	..	....	....
Del. & Hud. Canal Co.	....	....	....	....
" " East	8,724	93,775	....	48,332
" " West	2,063	19,227	....	12,721
South	8,081	32,597	....	....
Shamokin	3,363	51,749	12,749	81,496
Trevorton	....	....	..	....
Lykens Valley Coal Co.	....	....	....	10,046
Wyoming South	....	....	....	....
Wyoming North	....	....	....	....
P. N. Y. C. & R. R. Co.	4,972	61,909	51	34,371
Williamstown Col'y	5,892	33,808	....	....
Big Lick Col	....	....	89	13,313
Total	142,556	2,263 722	37,532	1,264,622
1870	37,532	1,264,622		
Increase week and year	105,024	999,100		

* Less coal transported for Company's use and Bituminous coal.
†Closed for the season.

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, March 11, 1871.

BY RAILROAD—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB VAL. BRANCH.

	Tons.	Cwt.
From St. Clair	398	01
" Port Carbon	100	18
" Pottsville	1,194	16
" Schuylkill Haven	1,105	13
" Pine Grove	8,162	16
" Tamaqua	14	00
" Harrisburg	3,651	00
" Dauphin	14,627	04
Total		

SHIPPED WESTWARD VIA NORTHERN CENTRAL RAILROAD.

Passing Locust Gap	2,585	01
" Shamokin	6,637	15
" Herndon	9,222	16
Total		

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	1,066	18
" Lebnaon & Pine Grove Branch	455	06
Total	1,522	04

CONSUMED ON LATERALS.

From Frackville Scales	142	09
" Mill Creek "	1,038	03
" Schuylkill Valley Scales	528	13
" Mt. Carbon "	178	12
" Oreasona "	29	07
" Pine Grove "	274	12
" Tamaqua "		
" Shamokin "		
" Trevorton "	2,191	19
Total		

LEHIGH AND WYOMING COAL.

Received via Allentown, L. Penn'a Br.		
" " Alburtis, "		
" " Plymouth R. R., G. & N. Br.		
" " Connecting R. R. "		
" " Willow Street R. R.		
Total		

BITUMINOUS.

From Harrisburg	11,351	02
" Connecting R. R., G. & N. Br.	10	04
" Junction R. R.	11,361	06
Total		

COAL FOR COMPANY'S USE.

Anthracite	2,321	04
Bituminous	558	08
Total	2,879	12

RECAPITULATION.

	Total for Week.	Corresponding week last Year.	
Passing over Main Line and Leb. Val. Branch	14,627 04	18,026 05	d3,399 01
For Shipment by Canal	—	1,951 11	d1,951 11
Shipped Westward via Northern Central R. R.	9,222 16	2,209 10	17,013 06
Shipped West or South from Pine Grove	1,522 04	506 02	i1,016 02
Consumed on Laterals	2,191 19	1,892 06	i 299 13
Lehigh and Wyoming Coal		190 12	d 190 12
Total Anthracite paying fr'gt	27,564 03	24,776 06	
Bituminous	11,361 06	7,320 06	
Total of all kinds paying fr'gt	38,925 09	32,096 12	
Coal for Company's use	2,879 12	1,088 08	
Total Tonnage for Week	41,805 01	33,185 00	
Since Dec. 1, 1870	725,064 00	775,766 05	50,703 05
Total to date	766,869 01	808,951 05	42,082 04

SHIPPED BY CANAL.

	Total for Week.	Corresponding week last Year.	
From Schuylkill Haven	—	—	—
" Port Clinton	—	—	—
Total Tonnage per Week	—	—	—
Since Dec. 1, 1870	—	—	—
Total to date	36,225 17	34,373 16	i1,852 01

Report of Coal Transported by the Lehigh Coal and Nav. Co.'s Railroads and Canals,

Week ending March 11, 1871–Compared with same time last year.

WHERE SHIPPED FROM	WEEK 1871., tons cwt.	WEEK 1870. tons ct.	YEAR 1871 tons cwt.	YEAR 1870. tons cwt.
Wyoming Region	2509 01	13764 08	52846 11	129280 07
Upper Lehigh Region		681 06	4641 06	7005 17
Mahanoy Region	48 09	44 17	832 17	1450 05
Hazleton Region				
Beaver Meadow Region			1043 03	
Trescow Region	118 16	20 16	17478 17	30089 18
Mauch Chunk Region				
Totals	2676 06	14511 09	76815 14	167786 07
Increase				
Decrease	11835 03		90970 13	
DISTRIBUTION.				
Forwarded East of Mch Chunk by Rail	1646 01	8149 05	65568 18	146349 02
Forwarded East of Mch Chunk by Canal				
Delivered at and above Mauch Chunk	952 11	358 06	9209 14	6903 04
Delivered to L. & B. R. R. at Plymouth Bridge		4794 15		10722 09
L. V. R. R. at Sugar N.	77 14	1209 03	2037 02	2411 12
Totals	2676 06	14511 09	76815 14	167786 07
Of the above there was transported on acc't of L. C. & N. Co.	118 16	1097 10	18715 04	38152 11
W.-B. C. & I. Co.	1719 05	2464 03	37593 09	48472 10
Totals	1838 01	3439 13	56310 13	86625 01
Increase				
Decrease	1631 12		30314 08	

Delaware and Hudson Canal Company.

The following is a statement of Coal transported by the Delaware and Hudson Canal Co., for the week ending March 11, 1871.

	WEEK.	SEASON.
By Del. and Hud. Canal		
By Railroad East	suspension.	48,332 00
" West		12,721 00
" South		
TOTAL TONS,		61,053 00
For the same period last year.		
By Del. and Hud. Canal		
By Railroad East	8,724 00	93,775 00
" West	2,063 00	19,227 00
" South	8,081 00	32,597 00
TOTAL TONS,	18,868 00	145,599 00

Pennsylvania Coal Company,

Shipments of Pittston Coal for the week ending March 11, 1871.

	1871. WEEK.	1871. YEAR.	1870. WEEK.	1870. YEAR.
By Railway	247 16	3,008 10	17,650 01	172,545 17
" Canal	—	—	—	—
Total	247 16	3,008 10	17,650 01	172,545 17
Decrease 169,537 07 tons.				

Report of Coal forwarded by Pa. & N. Y.

R. R. Co., for week ending March 11, 1871.

	BITUMINOUS. Tons.	Cwt.	ANTHRACITE. Tons.	Cwt.
By Rail	4,421	17	51	12
Previously this year	51,728	10	34,219	09
Total by Rail	....	..	34,371	01
By Canal	....	..	....	..
Previously this year	....	..	....	..
Total by Canal	....	..	....	..
Total for the year	56,150	07	34,371	01
To the same time last year	42,701	..	61,909	06
Increase	13,449	07	27,538	05

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending March 11, 1871, and previously this season, compared with same time last year:

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt
Total Wyoming	305 11	70,567 17
" Hazleton	1,160 14	206,415 08
" Upper Lehigh		442 06
" Beaver Meadow	1,713 15	73,875 05
" Mahanoy	8,541 15	76,204 07
" Mauch Chunk	88 04	1,595 19
Total Anthracite	11,309 19	429,101 02
Bituminous Coal from all sources		5,484 00
Total by rail and canal	11,309 19	434,585 02
Same time last year	41,041 17	718,075 07
Increase		
Decrease	29,731 18	283,990 05
Forwarded East from M'h Chunk by rail	10,308 16	366,829 09
Same time last year	35,355 04	631,390 07
Increase		
Decrease	25,046 08	264,560 18

RECAPITULATION.

Forwarded East from M'h Chunk by rail	10,308 16	366,829 09
To N. C. R. R., at Mount Carmel		18 00
Forwarded North from L. & B. Junction	51 12	34,161 05
To L. & S. R. R. at Packerton for rail	53 02	1,976 01
Delivered at M'h Chunk	47 08	356 01
Delivered on line of road above Mauch Chunk		3,310 11
Delivered above M. Chunk for use of L. V. R.R.	849 01	12,863 04
To L. & S. R.R., at P'n Hav., for railroad		94 10
Do. for canal		7,060 19
At M. Chunk for canal		2,431 02
Total Anthracite	11,309 19	429,101 02
Bituminous Coal		5,484 00
Total all kinds	11,309 19	434,585 02

Philadelphia and Reading R. R.

Amount of coal transported on the Philadelphia and Reading Railrodad, Saturday, March 11, 1871.

From St. Clair	
" Port Carbon	398 01
" Pottsville	100 18
" Schuylkill Haven	1,194 16
" Auburn	2,686 03
" Port Clinton	8,162 16
" Allentown and Alburtis	
" Harrisburg and Dauphin	15,016 02
Total paying freight	27,458 16
Coal for Company's use	2,952 04
Total for week	30,411 00
Previously this year	591,255 09
Total	621,666 09
To same time last year	686,384 00

Shipments of Cumberland Coal

or the week ending Saturday, February 25, and for the year 1871:

SHIPPED BY	B. & O. R. R.	C. & O. CANAL.	TOTAL.
Cooke M	.....	.....	.....
Borden	2,721 07	782 19	3,504 06
Consolidation	5,792 02	522 07	6,314 09
Spruce Hill	783 09	.....	783 09
Midlothian	1,523 06	1,155 12	2,678 19
H. and Baltimore	1,230 09	867 12	2,098 01
do Va M	1,793 08	.....	1,793 08
V C & I Co	1,669 05	.....	1,669 05
G. C. C. and I	1,602 01	459 04	2,061 05
Big Vein	2,090 03	.....	2,090 03
Maryland	2,131 14	2,144 15	4,276 09
American	2,121 16	.....	2,121 16
Atlantic	1,209 00	.....	1,209 00
Piedmont	1,709 10	.....	1,709 10
Swanton	1,105 00	.....	1,105 00
Barton	782 00	.....	782 00
Potomac	1,307 15	.....	1,307 15
George's Creek M. C.	.....	.....	.....
Franklin	1,690 10	.....	1,690 10
Total week	31,262 15	5,932 09	37,195 04
Previous	139,722 19		139,722 19
Total year	170,985 14	5,932 09	176,918 03

Prices of Coal by the Cargo.

[CORRECTED WEEKLY.]

Company Coals.

March, 1871.

No quotations during strike.

	L.	Str.	Gra.	Eg.	Sto.	Ches
Scranton at E. Port	—	—	—	—	—	—
Pittston at Weehawken	—	—	—	—	—	—
Lackawana at do	—	—	—	—	—	—
Wilk'b're at Hoboken	—	—	—	—	—	—
Old Co. Lehigh at Pt. Johnston	—	—	—	—	—	—
Lehigh at E. Port	—	—	—	—	—	—

For freights to different points, see "Freights."

AT NEW YORK, March 18. SCHUYLKILL.	R. A.	W. A.	AT PHILADELPHIA, March 17. R. A.	W. A.
Lump	$— —	$— —	— —	— —
Steamer	— —	— —	— —	— —
Broken	— —	— —	— —	— to —
Egg	— to —	— to —	— —	— to —
Stove	— to —	— —	— —	— to —
Chestnut	— to —	— —	— —	— to —
Pea	— —	— —	— —	— —
LEHIGH.				
Lump, (along side)	— —	— —	— —	— —
Broken	— —	— —	— —	— —
Egg	— —	— —	— —	— —
Stove	— —	— —	— —	— —
Chestnut	— —	— —	— —	— —
Pea	— —	— —	— —	— —
SPECIAL COALS.*				
Diamond Vein	R. A. 8 00		— —	— —
New England	" — —		— —	— —
Locust Dale	W. A. 7 50		— —	— —
Honey Brook, Le'h	W. A. 10 00 to 12 00		— —	4 75
Spring Mountain	" 10 00 to 12 00		— —	4 75
Sugar Creek	" 10 00 to 12 00		5 25	— —
Sugar Loaf	" 10 00 to 12 00		5 75	— —
Old Comp'y's	" 10 00 to 12 00		— —	— —
Cross Creek	" 10 00 to 12 00		— —	— —
Room Run	" — —		— —	— —
Girardville	" — —		— —	4 75
McMichael	" — —		— —	4 75
Shamokin	" — —		7 50	— —
Lykens Valley	" — —		5 75	— —
Broad Top	" — —		7 50	— —
Hill & Harris	" — —		— —	— —
Henry Clay	" — —		4 75	— —
Powelton	" — —		5 00	— —
	" — —		7 50	4 75

[*Dealers in these coals may be found in our advertising columns.]

Prices for Coal at Mauch Chunk.

March 1871.

BITUMINOUS COALS.

Kittaning Coal Co.'s Phœnix Vein f.o.b. at Phila.	$	—
" Lemon " " "		—
Cumberland Vein Coal		—
Consolidation Coal Co.'s on board	N. Y.	—
Maryland Coal Co. "	"	—

Prices at Baltimore—March, 1871.

Wholesale Prices to Trade.

Wilkesbarre, by cargo or car load	$	—	—
Pittston and Plymouth, do		—	—
Shamokin Red or White Ash, do		—	—
Lykens Valley Red Ash, do		—	—
Zerba Valley		—	—
Treverton		—	—
By retail, all kinds per ton of 2240 lbs		—	—
Georges Creek & Cumberland f. o. b. at Locust Point for cargoes		4 60	4 75
Fairmount and Clarksburg gas, f. o. b. at L. Point		6 00	6 50

Prices at Georget'n, D.C., & Alexandria, Va.

March, 1871.

George's Creek and Cumberland f. o. b. for shipping $4 75

Prices at Havre de Grace, Md.

Wilkesbarre and other White Ash for cargoes	$	—	—
Lykens Valley		—	—
Shamokin Red or White Ash		—	—
Trevorton and Zerba Valley		—	—

Prices of Gas Coals.

March, 1871.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr., 41-43 Pine st., N.Y.

Duty, $1 25, gold

	Coarse	Slack.
Block House	$1 75	@-75
Gowrie	1 75	@-75

Corrected by Bird, Perkins & Job, 86 South street.

	Coarse.	Culm of Coal.
Pictou	$2 25	@1 25
Sydney	2 25	@- 80
Lingan	1 60	@- 80
Little Glace Bay	1 60	@1 00
Caledonia	1 60	@- 80

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty $1 25 per ton, gold, on the coarse coal. 25 per cent. ad valorem on the Culm of Coal.

AMERICAN.

	Currency.	
Westmoreland	7 10	@7 25
Fairmount Gas Coal Co. of N. Y.	7 50	@- —
Despard Coal Co	$7 50	@- —
Penn	7 75	@8 00
Newburg Orrel Gas	— —	@- —
West Fairmount Gs Caoal	8 00	@- —

AT PHILADELPHIA.

Powelton $7 80

Prices of Foreign Coals.

March, 1871.

Duty $1 25 per ton.

Corrected weekly by PARMELE BROS., No 32 Pine street New York.

Liverpool Gas Caking	$ 9 00	@— —
" " Cannel	11 50	@12 50
" " House	— —	@16 00
" " Orrel	12 00	@14 00

Per ton 2,240 lbs., ex-ship.

PRICES FROM YARD.

Liverpool House Orrel, screened	$16 00	@17 50
" " Cannel, "	18 00	@20 00

Per ton 2,000 lbs. delivered.

Freights.—March, 1871.

TO EASTERN PORTS.	From Philadel'a.	From R. Port and Port Johnston.	From Newbury	From Rondout
Amesbury	$2 50	$2 00		
Bangor	2 30	1 60		
Bath	2 30	1 75		
Boston	2 10	1 85		
Bridgeport	1 75	1 00		
Bristol	2 00	1 40		
Cambridgeport	2 75	2 00		
Derby	2 00	1 20		
Dighton	2 30	— —		
East Cambridge	2 35	2 00		
Fall River	2 00	1 40		
Hackensack	1 75	1 00		
Hartford	2 50	1 50		
Jersey City	1 40	60		
Middletown	2 25	1 25		
Mystic	— —	1 25		
New Bedford	2 00	1 40		
Newburyport	2 65	1 85		
New Haven	1 90	1 00		
New London	1 76	1 25		
Newport	2 00	1 40		
New York	1 35	60		
Norwalk	1 80	1 00		
Norwich	2 00	1 30		
Pawtucket	2 30	1 50		
Portland	2 30	1 50		
Portsmouth, N. H.	1 45	1 85		
Providence	2 00	1 25		
Rockport	2 10	1 65		
Saco	2 25	1 75		
Sag Harbor	1 70	1 20		
Salem	2 35	1 65		
Stamford	2 00	1 00		
Stonington	2 00	1 30		
Taunton	2 30	1 75		
Warren	— —	1 40		
Washington	1 25			
TO RIVER PORTS.				
Albany				
Catskill				
Cockszackie				
Coeyman's				
Cold Spring				
Fishkill				
Haverstraw				
Hudson				
New York				
Nyack				
Poughkeepsie				
Rhinebeck				
Rondout				
Saugerties				
Sing Sing				
Stuyvesant				
Tarrytown				
Troy				
West Point				
Yonkers				

Foreign and Provincial Freights.

March, 1871.

Closed for the winter.

Foreign.

Newcastle and Ports on Tyne, per keel of 21 1-5 tons £14 00@£16 00

Liverpool, 5 per cent primage 12s @16. ton

TO NEW YORK.

Provincial.	
Sidney	$ —
Lingan	—
Cow Bay	—
Port Caledonia	—
Little Glace Bay	—

TO BOSTON.

Sydney	$ —
Lingan	—
Cow Bay	—
Port Caledonia	—
Little Glace Bay	—

Rates of Transportation to Tide Water.

Closed for the Season.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

Philadelphia and Reading Railroad, from Port Carbon	$4 00
Less drawback of 50 cents on all Coal shipped east of New Brunswick and south of Cape Henry.	

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Easton	$1 84
C. R. R., N. J., Easton to Elizabethport	2 69
Shipping expenses at Elizabethport	25
Warfage	10
Total	$4 88

MAUCH CHUNK TO PORT JOHNSON.

L. V. R. R., or L. & S. R. R. from M. C. to Easton	$1 84
C. R. R., of N. J., Easton to Pt. Johnson	2 72
Shipping expenses	25
Warfage	10
Total	$4 91

TO HOBOKEN.

L. V. R. R., Mauch Chunk to Easton	$ —
Morris & Essex R. R. Easton to Hoboken	—
Shipping expenses	—
Warfage	—
Total	$ —

TO SOUTH AMBOY.

L. V. R. R.,	—
R. & D. R. R.,	—
Cam. & Am. R. R.	—
Shipping Expenses,	
Total	$ —

PENN HAVEN TO ELIZABETHPORT.

L. V. RR. Penn Haven to Easton	—
C. RR. of N. J. Easton to Elizabethport	—
Shipping expenses	—
Wharfage	—
Total	$ —

METALS.

NEW YORK, March 17, 1871.

IRON.—Duty: Bars, 1 to 1¼ cents ₱ lb; Railroad, 70 cents ₱ 100 lbs.; Boiler and Plate, 1¼ cents ₱ lb; Sheet, Band, Hoop, and Scroll, 1¼ to 1¾ cents ₱ lb; Pig, 7 ₱ ton; Polished Sheet, 3cents ₱ lb; Galvanized 2¼; Scrap Cast, $6; Wrought, 8 per ton.

	Store Prices.
Pig, Scotch No. 1, ₱ ton	31 00@34 00
Pig, American, No. 1	34 00@35 00
Pig, American, No. 2	32 00@34 00
Pig, American, Forge	31 00@32 00
Bar Refined, English and American	— —@75 00
Bar Swedes, assorted sizes (gold)	85 00@100 00
	Store Prices, Cash.
Bar, Swedes, ord'y sizes, less 5 ₱ ct.	110 00@115 00
Bar, Refined " "	77 00@ — —
Bar, Common " "	85 00@ — —
Scroll "	— —@ — —
Ovals and half-round " "	100 00@120 —
Band " "	92 00@105 00
Horse Shoe " "	92 50@ 95 —
Rods, ⅝ to 3-16 inch " "	82 50@120 —
Hoop " "	100 00@140 00
Nail rod	— —@6¾ —
Sheet, Russia, as to Nos. (gold)	10½@—11
Sheet, Single, D. and T. Common	—4½@— 6
Sheet, Galv'd, Nos. 14 to 26 10 and 12c. Nos. 27, 28, and 29, 13@14	
Rails, English (gold), ₱ ton	54 50 @59 00
Rails, American, at Works in Pa	70 00 @72 00

STEEL.—Duty: Bars and ingots, valued at 7 cents, ₱ lb or under, 2¼ cents; over 7 cents and not above 11, 3 cents ₱ lb; over 11 cents, 3½ cents ₱ lb, and 10 ₱ cent ad val. (Store prices.)

English Cast (2d and 1st quality) ₱ lb	— 15	@— 18
English Spring (2d and 1st quality)	— 7	@— 10
English Blister (2d and 1st quality)	— 10	@— 17
English Machinery	— 11½	@— 14
English German (2d and 1st quality)	— 13	@— 15
American Blister "Black Diamond"	— —	@—12
American, Cast, Tool do.	— 16	@— 17
American, Spring, do.	— 9	@— 11
American Machinery, do.	— —	@— 12
American German, do.	— 9	@— 12

COPPER.—Duty: Pig, Bar, and Ingot, 5; old Copper 20 cents ₱ lb; Manufactured, 45 per cent. ad val.

	All Cash.
Copper, New Sheathing, ₱ lb	— @— 30
Copper Bolts	— @— 32
Copper Braziers, 16oz. and over	— @— 32
Copper Nails	— @— 37
Copper, Old Sheathing, &c. clean	19 @— 20
Copper, Chili Pig	— @—
Copper, American Ingot	21¼@— 21¾
Yellow Metal, New Sheating	— @— 22
Yellow Metal Bolts	24 @— —
Yellow Metal Nails	— @— 22

LEAD.—Duty: Pig, $2 ₱ 100 lbs.; old Lead, 1½ cents ₱ lb: Pipe and Sheet, 2¾ cents ₱ lb.

Galena, ₱ 100 lbs	$— — @— —
Spanish (gold)	6 20 @6 25
German, do.	6 20 @6 25
English, do.	6 20 @6 50
Bar (net)	— — @8 75
Pipe (net)	— — @10 25
Sheet	— — @10 25

Colwell, Shaw & Willard Tin-Lined Pipe 15 cts. ₱ lb.

TIN.—Duty: Pig, Bars, and Blocks, 15 ₱ cent. ad val.; Plate and Sheets and Terne Plates, 25 ₱ cent.; Roofing 25. ad val.

	Gold ₱ lb.
Banca	33¼@—
Straits	32¾@33
English	— @32¼

PLATES.

Fair to Good Brands.	*Gold.*	*Currency.*
I. C. Charcoal, ₱ box	$8 @2¼@9 00	$10 00 @10 50
I. C. Coke	7 37½@7 75	8 37½@ 8 75
Coke Terne	6 25 @7 25	7 25 @ 8 50
Charcoal Terne	7 87½@8 25	9 00 @ 9 50

REMARKS.

IRON.—The business in Scotch Pig has been confined to small parcels to meet the immediate wants of the trade, but the supply is moderate and prices remain firm. We notice sales of 100 tons Eglinton at $32; 90 do. Gartsherrie, $33; 75 do. Glengarnock, $33; and 150 do. Carmbroe, to arrive, on private terms. There continues an active demand for American, and as there is very little obtainable, a further advance has been established; 800 tons No. 1 Lehigh sold at $35.50; 400 do. Allentown, $35; and 200 do. Forge, at Jersey City, $28, cash; we quote No. 1 $35 @ 36, and No. 2 $32@34. Wrought Scrap has been in good request, and we notice sales of 700 tons, here and to arrive, part at $39.50; and 150 do. old Car Wheels, $34.50. New Rails have been rather quiet since our last, but prices are unchanged. Old Rails are in demand, and sales are reported of 2,000 tons, to arrive, on private terms. Refined Bar is very firm at the advance noticed, and makers are especially firm, in view of some signs of a strike among the workmen.

TIN.—Pending the result of the Dutch sale, the market for Pig remains very quiet. Straits, however, is held with more confidence, as the London market, which had been down to 128s. 6d., had reacted to 131s. after the announcement that only 80,000 slabs were declared for the approaching Dutch sale; we quote nominally Straits 32¾@33c., English 32¾, and Banca 38½, all gold. Plates are without change, and there continues a steady, moderate business; the sales are 1,500 boxes Charcoal Tin, at $8.62½ @ 8.75; 700 do. Charcoal Terne, $7.87½@8, gold; and 500 do. I C Coke Tin on private terms.

LEAD.—Pig is quite dull, though prices are without quotable change; we have but to report 30 tons Spanish at $6 20 gold. Bar 8¼c., and Sheet and Pipe 10½ cash, less 10 per cent. to the Trade—Tin lined Pipe, 15, less 10 per cent. to the Trade.

COPPER.—The manufactures of Copper and Yellow Metal are steady at our quoted rates. Ingot is very quiet; it is understood that most of the cheap lots have now been picked up, and the market may be called a little firmer: the sales have been confined to 25,000 lb., Tennessee at 21½c.; and small lots of Lake, 21¾@22, cash.

ZINC.—Spelter, foreign, 5c., gold, per lb.; Sheet Zinc, foreign, 8c., gold, per lb.; Spelter, domestic, 11c. curr.; Zinc Paint, French, dry, 10c.; do. American, 11c.; Manganese, 4½c.

The Slate Trade.

[Corrected weekly.]

(A "square" represents 100 superficial feet.)

PRICES OF ROOFING SLATE.

Vermont purple, 1st quality, per square	$6 50@ 7 00
" green, 1st " "	6 50@ 7 00
" red, 1st " "	15 00@16 00
" variegated, "	5 75@ 6 20
d. b'k and d'k blue, 1st qual., "	6 00@ 7 05

Borax in Inyo County, California.

The Inyo *Independent* of January 13th says: A large deposit of borax has been discovered at or near Fish slough, five or six miles from the bridge across Owens river, in Bishop creek precinct. The borax is found in beds, is slightly impregnated with saltpetre, and, after having been tested at several blacksmith shops, is pronounced of the best quality. The claim is owned by BROCKMAN, RYAN, WESTERFIELD, and others, and knocks the spots out of any similar borax operations at Clear Lake or in Esmeralda. Mr. RYAN will go to San Francisco shortly with some 5,000 pounds of the article.

The Archimedean Screw for the Lifting of Water.

AT a meeting of the English Institution of Civil Engineers, Mr. WILFRED KING read a paper intended to supply information regarding the best form of Archimedean screw, and its effect when laid at different angles of inclination to the horizon. After suggesting that the previous neglect of this subject was probably owing to the mathematical and practical difficulties attending the construction of screws in the ordinary way, viz., with the threads at right angles to the surface of the core, the author stated that he had adopted another principle of forming the spiral threads, which would simplify the work of construction and produce a more efficient machine. This was to make the spiral threads on the natural and developable system. If an annular piece of card or tin be wrapped upon a cylindrical core, having its edge retained in a shallow spiral groove on the surface of the core, it would naturally take up a fixed and determinate position, not at right angles to the surface of the core, but inclined to it; and inclined to it at an angle depending only upon the inclination of the spiral groove on the core. The chief advantage of this spiral thread was that it could be made of a single flat piece of plate, and no work was required, except to cut out an annulus, which, when wrapped upon the core, gave at once the spiral surface; whereas, the threads at right angles to the surface of the core could only be constructed approximately, by using a great number of small pieces. The developable threads also produced a more efficient machine than the threads of the usual form, as was shown by reference to tabular diagrams. The first set of experiments was made with the models of screws of different spiral angles (the "spiral angle" of the screw being the inclination of a spiral line on the core to the lines parallel to the axis of the core) having only one thread apiece, and the results of these experiments were given on the diagrams; but it was easily seen that every screw ought to have as many threads as ordinary workmanship and convenience would allow. This was also shown by reference to the results of experiment; and it was concluded that, to allow of easy fitting, riveting and examination, the width of the chambers for a large screw should not be less than 18 inches on the square. This condition was used to regulate the number of threads for the models for the second set of experiments. The second set of experiments was made on six models, whose spiral angles were 20°, 30°, 40°, 50°, 60°, 74°; the number of threads being varied from four to one. The models were successively inclined at different angles, and the water contained by each model, in its different positions, was measured by a measuring glass. These experiments formed the basis of the investigation, and it was deduced from them:—(1.) That the quicker the spiral, the flatter must the machine be laid to produce its best effect. (2.) That screws of quick spiral angle, when laid at their best angle of inclination, delivered a far greater volume of water per revolution than those of slower spiral angle when laid at their best angle of inclination. In order to ascertain the most economical form of screw, it was necessary to investigate the loss of power due to the internal friction of the water and the external friction on the gudgeons for each machine.

This was done by calculation, and the results were obtained numerically for screws of certain specified size, lifting to a height of ten feet. The frictional drawbacks thus obtained were applied to each machine when laid at its best angle of effect, and the efficiencies of the different screws were then calculated. The result showed that the machine whose spiral angle was 30° was the most economical, but that the machine whose spiral angle was 40° approached it very closely. The best angles of inclination for these two machines were respectively 25° and 30° to the horizontal. In the most favorable case, the useful effect of the screw appeared at 88 per cent., and it was concluded that, after making allowance for certain small losses referred to, the useful effect of a well-constructed screw should not be less than 85 per cent. Reference was then made, by way of comparison, to other machines commonly used for low lifts, viz.: suction pumps, centrifugal pumps, open Archimedean screws, scoop wheels, chain pumps, and Persian wheels; and the paper concluded by pointing out the various advantages of the Archimedean screw, more particularly as regards its durability, simplicity, and useful effect. The communication was illustrated by the series of models from which the results were obtained, and also by a screw, 5 feet in length, constructed on the system of threads advocated by the author. A model was likewise exhibited, to show the improvements which might be applied to obviate the defects of scoop wheels, as at present constructed and mounted.

Coal Question.

THE following opinion of the Attorney General of the State in regard to the liabilities of the railroad companies, which have engaged in the conspiracy to prevent the production of coal, will be read with interest:

OFFICE OF THE ATTORNEY GENERAL,
HARRISBURG, Feb. 25, 1871,

To His Excellency, John W. Geary, Governor:

SIR: I have the honor to acknowledge the receipt of your communication enclosing a copy of the Senate resolution of the 24th inst., requesting at the earliest possible moment my opinion upon the power of railroad companies to impose rates of freight by which the cost of coal is double to the consumer, and the public threatened the total loss of this indispensable article.

The subject therein referred to has received careful consideration. I regret that the brief time allowed for the preparation of this report prevents me from stating more than the conclusions to which I have arrived, without permitting me to give the reasons and authorities by which they are supported.

I am of opinion that as to all companies incorporated after the adoption of the Constitution of 1838, the remedy for any injury to the public is entirely in the hands of the Legislature.

The right of railroad and transportation companies to impose rates of freight is a franchise, the extent of which should always be carefully limited in the charter conferring the privilege. A sample of the manner in which the charters of these companies profess to protect the public interests is to be found in an act of incorporation approved April 4, 1833. The restriction there used is in these words: "The toll on any species of property shall not exceed an average of four cents per ton per mile." (P. L. 1832-3, p. 154.)

These words received a judicial construction in the case of BOYLE vs. Railroad Company (4 P. F. SMITH, 310), wherein it was ruled that the company "might charge for transportation in addition to the toll."

Judge STRONG, in a learned opinion, examines the whole subject. He says: "The Legislature must be considered as having used words in the ordinary signification, and especially so when their technical sense and their ordinary signification are the same. The legal meaning of the word 'toll' is and always has been well defined. It is a tribute or custom paid for passage, not for carriage—always something taken for a liberty or privilege, not for a service; and such is the common understanding of the word. Nobody supposes that tolls taken by a turnpike or canal company include charges for transportation, or that they are anything more than an excise demanded and paid for the privilege of using the way."

It is very much to be regretted that the power to charge for transportation should thus have been placed by the Legislature almost entirely at the discretion of the carrying company.

It would be a large saving to the Commonwealth if all bills could be thoroughly examined and reported upon by a competent commission, and thus the use of a single unapt word might not be the occasion of litigation, and perhaps injury.

The right of each transporting company in this particular is only to be ascertained by a thorough examination of its charter and supplements. If the expression above quoted is used in all similar acts, the power to charge seems to be without limit, save only,

I. In the discretion and responsibility of the gentlemen composing the board of directors, and

II. In the constitutional authority of the Legislature.

The latter safeguard is in the 26th section of article I, and is in these words: "The Legislature shall have the power to alter, revoke or annul any charter of incorporation hereafter conferred by or under any special or general law, whenever in their opinion it may be injurious to the citizens of the Commonwealth, in such manner, however, that no injustice be done to the corporators."

If the cost of coal has been "doubled to the consumer, and the public threatened with the total loss of this indispensable article," a case is certainly presented of great "injury to the citizens of the Commonwealth," which, if within the constitutional protection, may certainly be remedied by legislative enactment. It may not be improper to add that even for the performance of a lawful act, the law does not permit parties to combine, if the intent is individual benefit at the expense of public right. This is what Chief Justice GIBSON refers to in Commissioner CARLISLE, BRIGHTLEY'S Rep., 36, when he spoke of the "object to be attained as a consequence of the lawful act."

In Commonwealth vs. TACK, Judge LUDLOW applied this principle to a combination to raise the price of oil, and held that where there is an intent to benefit the "parties concerned, to the prejudice of the public, by force, fraud or menaces where prejudice and oppression are the natural and necessary consequences, the offence is indictable."

The result is, therefore, to be thus stated. When the wrong referred to in the Senate resolution is perpetrated by a single corporation whose charter is dated subsequent to 1832, the Legislature can exercise its power. When two or more companies conspire to oppress the public, the officers are indictable.

With great respect, your ob't servant,

F. CARROLL BREWSTER,
Attorney General.

We are pleased to know that the Legislature has determined to move with energy in this matter, and will afford all possible relief to the people, who are now suffering through the high-handed extortions of soulless monopolies. It is thought that at an early day the corporations, which have jointly conspired to increase the price of a most important article of general consumption, will be brought up with a "round turn." And so mote it be.—*Luzerne Weekly Union.*

Tax-Titles to Mining Claims.

EXCHEQUER MILL, Alpine County, Cal., March 1, 1871.

TO THE EDITOR—SIR: I have read with much interest your remarks on the new mining law passed by the Senate a few days ago, and acknowledge with you its great value and importance. No one at all conversant with the present state of this law will withhold from Senator STEWART the meed of praise to which his exertions in this direction so justly entitle him. Engaged as I have been for three years in the business of mining for an English company in this county, I have frequent opportunities of acquiring mining claims of such apparent value as would, though undeveloped, justify me in recommending their purchase at home; but a very cursory investigation of the title in most cases entirely forbids any negotiations with a view to buy;—a state of things which cannot but retard the development of the mineral resources of this and other parts of the country similarly situated.

The act which has just met the approval of the Senate will certainly remove many of the anomalies of the existing law—the natural sequence of ill-digested resolutions—the inevitable result of basing the law on mining customs, the offspring often of hurriedly called meetings of excited and not over educated miners,—those hardy pioneers who made the discoveries and organized the mining districts, men whose forte lay more in the pick and shovel than the pen,—laws sufficient perhaps to meet the exigencies of the time of their creation, but altogether inadequate to grapple with conditions evolved by an increased floating population and the competing interests naturally emanating from subsequent developments, transfers and abandonments of the original locations, "crudis indigestaque moles," at the best, a law to-day, a thing of the past to-morrow, abrogated and annulled by another miners' meeting, convened not impossibly in the interests of certain sets or projects, the laws of the United States notwithstanding. The provisions of the new act as to location, their extent, boundaries and general definition, tunnel discoveries, patent applications, amount of work to be performed and forfeiture, appear to leave nothing to be desired in these respects, except perhaps that section five might have defined more clearly how it is to be ascertained that the amount of work has been performed, so that the $25 worth of work of 1871 may not be made to do duty for '72, '73, &c. But, in this county, there would still remain a difficulty as to title not met by the Senator's bill; and although, as I think very possible, it may have its existence in no other county but Alpine, it is to this difficulty to which I would take the liberty of directing your attention.

Here, since 1867, it has been the practice to tax, both for county and State purposes, all mining claims, developed or undeveloped, producing or non-producing, having improvements or without, patented or unpatented; the assessor listing them under the head of "Real Estate." It is not my object now to discuss the legality of this tax, but only in so far as it bears on the mining title. My views as to the illegality of any tax on undeveloped, unpatented mining claims were given at length in a letter I addressed to the *Mining and Scientific Press* in October, 1869 (copy herewith), and I need not now repeat them. As a matter of fact, the tax *is* imposed, and confirmed on appeal by the Board of Equalization; the owner fails to pay, the property is advertised for sale in virtue of powers contained in the revenue acts, I buy, and receive at the expiration of the six months allowed for redemption a sheriff's deed, take possession, and having enlisted foreign capital, commence and carry on the work of development with energy and means. After expending some $30,000, $40,000, or even $100,000, my exertions and the confidence of my friends are rewarded by the discovery of a rich body of ore. Till then, the quondam owner or locator, who, up to this time, had strictly complied with all the requirements of the mining laws of the district, or, for the sake of argument, let it be with all the regulations and stipulations as to work, &c., contained in this act of 1871, and the mining rules to be made law by section five of said act; till then this owner remains quiescent, or merely protests against the sale and adverse occupation. The moment the rich strike is made he commences suit for the recovery of his property, which, if I understood the law aright, he can do within the two years allowed by the act of 18th April, 1864, or, should this act be, as I have heard it maintained, invalid, within the five years prescribed by the Statute of Limitations.

Should he succeed in proving the *tax* illegal, the title following on the tax sale must of course follow suit. I am ousted for believing in the assurance of the county officials, whose object it is to get as much money into the treasury as possible. My patient friend the original owner is installed in my place, and, thanks to the more than usual "glorious uncertainty" of the law in this particular, reaps the benefit of the capital and labor bestowed on the claim by my victimized friends, and of his obstinate and persistent disobedience of the dicta of the learned dispensers of law and justice in the county of Alpine. The accompanying copy of the Alpine *Chronicle* will show you to what an extent this system of things prevails in this county; one-half of the fourth page being occupied almost entirely with six or seven line advertisements of delinquent taxes on mining claims, most of which will soon be advertised for public sale. I do not object to a nominal tax on an non-patented mine, *if I know it to be collectable by the laws of this country*, and, though I hold that it was not the intention of the Legislature to assess mining claims, and that they are not "property" in the sense of the revenue acts till patented, I pay the tax rather than litigate; but what I contend for, and the object of my present writing is this, that, now that the mining law is to be amended and much of the darkness that has hitherto enshrouded it dispelled by an act that he who runs may read, a golden opportunity presents itself for setting at rest this question also, not so much as to the legality of the tax, but as to the effect I have attempted to show the uncertainty of its legality has on the mining title.

A few words appended to the Senator's bill would do it, a simple clause to the effect that a sheriff's deed following on a tax sale of a mining claim unpatented, and upon which no buildings or other improvements have been made other than the $25 of annual work prescribed by the act, shall be a good and valid title to such claim, or, if the tax is not intended to be imposed, shall give no title to such claim except *quoad* the improvements. I am aware that all improvements, such as houses, blacksmiths' shops, &c., are taxable; on this the law appears to be quite explicit, but there are many claims taxed here and sold for taxes that have no improvements upon them whatever, a tunnel or shaft not being an improvement in the sense of the revenue acts.

This is what I would suggest for Senator STEWART'S consideration, had I the privilege of his acquaintance. As I have not the privilege, I must content myself with making the suggestion, if you will allow me, through the columns of your valuable paper. Such a declaratory enactment would have a most beneficial effect, whether in favor of taxation or not. The learned Commissioner of Mining Statistics, in his able report to the Treasury, 1869, tells us plainly, page 216, that there is no Federal taxation on mining claims; on the subject of taxation for State or county purposes he is silent.

Remove this doubt, and you demolish at once one great barrier here to the introduction of foreign capital; claims now held by parties unable to develop them would pass, on terms mutually satisfactory, into other hands; the capital thus induced, while it gave a stimulus to other enterprises, would speedily solve the problem of the mineral wealth of the country—a solution not likely to be arrived at for many a long year unless extraneous capital be encouraged by the removal of all ambiguity from the mining title.

The British public, for instance, have been introduced so frequently to American wild cat, that it is no easy matter to enlist their capital for legitimate mining enterprise in this country. How few of those who have gone to England for the purpose of selling even good mines, with undoubted titles, have accomplished anything. Let the mine be ever so good, but any cloud exist about the title, you can do nothing; no *risks* will be taken in this direction.

Should it be the opinion of the Legislature that a tax on unpatented mining claims is advisable, and likely to encourage mining industry, so be it; but let it be nominal till returns justify a substantial contribution to the support of the county and State; and, above all, let there be some uniform rule on which the assessment shall be based—not the mere caprice or incompetency of an official, or the arbitrary decision of a Court of Appeal, no one member of which ever saw the claim, or could tell you the difference between oxide of iron and ruby silver—and no loophole for such a contingency as that A having 1,000 feet on lode B shall be assessed on $1,000, while C, owning 1,000 feet on the same lode, both undeveloped and both showing equally good, bad, or indifferent, should get off with $100. Establish the legality of the tax, and you establish the legality of the tax title; proclaim the tax illegal, and no such title will be offered, and no competition exist between the real owner and the purchaser at such a sale.

At the present moment there are operating in this county three Eastern and four English companies, and a considerable amount of foreign capital is expended. From three mines ore has been taken out (picked specimens) that will assay from $2,000 to $3,000 per ton, and there are many claims advertised in the paper sent you that give more outside promise than the best of these, and for which a market would be found were we assured of the sufficiency of the title so acquired, or that after buying at the sale we should not have to satisfy the demands of the previous owner.

Therefore, I say, let your Legislature give forth no uncertain sound in this matter; if there is to be a tax, let us know what it is, and that the title given by the sheriff to a purchaser, at a sale of claims for delinquent taxes, is to all intents and purposes *what it is* HERE *represented to be*, good and valid, provided the requirements of the act (of 1871) are complied with.

LEWIS CHALMERS,
Manager Exchequer G. & S. Mining Co.

Ferrie's Blast Furnace.

A FOREIGN exchange gives the following description of Mr. WILLIAM FERRIE'S blast furnace, which, four months ago, was lit up at the Monkland Ironworks, Calderbank, near Glasgow. The furnace, we learn, is constructed on the bell and cone principle, neither flame nor smoke being allowed to escape at the top of the furnace. The coal is self-coked in four descending compartments or retorts, and the heat necessary for this purpose is created by the burning of the waste gases in a series of flues arranged around the retorts. In addition to an ample supply of gas obtained by the destruction of coal during the process of reduction and employed for the self-coking of the coal, an enormous surplus is given off, and, as we shall see by and by, is utilized in other departments of the work. Not only is there a sufficiency of gas to sustain a temperature ranging from 1400° to 1700° Fahr., in the flues, but a capacious pipe leads off a surplus to a distance of several hundred feet. From this main pipe gas is withdrawn to supply the heaters of other three furnaces, and this, too, in addition to supplying the heaters connected with the patent furnace, maintaining a heat higher and more regular than could ever be obtained by the employment of dross. This gas leaves the furnace at such a temperature as to render it highly and easily combustible. As to tar and other effete material supposed to be created during the operation of this furnace, it has been found not to exist. It is only the situation of the valves connected with the main pipe, where the permeating gas comes incidentally in contact with the atmosphere, and becomes condensed, that any appearance of tar is found to exist, and then only to a trifling extent. This can easily be accounted for, from the fact that the gas is driven off in such a state of dryness as to prevent all likelihood of this occurring, so that the tar is volatilized along with the other volatile constituents of the coal, the temperature at this point being about 500° Fahr.

What economic value is obtained from the Ferrie furnace? What are its advantages over the ordinarily constructed furnaces in use throughout Scotland? The ordinary hot-blast furnace requires for the production of every ton of pig iron fifty cwt. of coal; whereas by this new process it is an ascertained fact that thirty-four to thirty-six cwt. of coal will produce a ton of rich No. 1 iron, thereby effecting a saving of seventeen cwt. of coal on every ton of iron made, or equal to 4s. 6c. In addition to this saving in coal, it will be seen from the following table that there is also a saving of 3 cwt. in ores, or equal to 2s. 5d. on every ton of pig iron produced.

Nor is this all; for although those two items are the primary points of importance in the patent, it is also an ascertained fact that the heating power of the gas derived from the patent furnace represents in value—by saving a former consumption of twenty-two tons 8 cwt. of dross in the twelve hours at 2s. per ton—£2 4s. 10c., or equal to 3s. on the ton of iron made by this furnace. Thus upon its producing capacity for the year it gives a saving in dross alone of £1,500. This is exclusive of cost for the removal of ashes, wages, &c., which is equal to other 3d. on the ton of iron, or £125 per annum. No doubt, in a range of eight or twelve hot-blast furnaces, the quantity of gas produced would be more than sufficient for the raising of steam and heating of blast, and that possibly for a time a portion might not be utilized, but its known value is calculated to suggest other means for its application, such as calcining ironstone, &c.; but in circumstances such as exist at the Monkland Works, where there is a very large malleable work in addition to the manufacture of pig iron, the surplus gas can be applied to nearly its full extent, and thus form in the malleable department alone a very important saving in fuel. The saving proved to be effected in one furnace constructed on this principle amounts in coal to 4s. 6d., in ores to 2s. 5d., in dross to 3s. 3d., or equal to 10s. 2d. on every ton of iron this furnace makes, being equal in one year on a production of 10,000 tons to a sum no less than £5,083 6s. 8d. The following table gives the data carefully taken in estimating the comparative advantages of the new over the old open-top furnaces:—

Table showing the comparative results of the patent furnace, No. 6, with an ordinary fifty feet open-top furnace, No. 7, of the best modern construction, dating respectively from January 21st to February 10th, 1871, inclusive, being a record of forty-two shifts—the materials used are the same in both cases, with the additional advantage that in No. 7 the heaters are fired with the gas obtained from the patent furnace No. 6, thereby receiving a steady temperature of blast equal to melting zinc at the external opening of the nozzle of the tuyere.

MATERIALS USED.

NO. 6, OR PATENT.

Coal.		Ores.		Limestone.	
Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.
1,144	15	1,127	4	409	11

Materials used per ton.

Cwt.	Cwt.	Cwt.
36·1	35·5	12·9

Production of Pig Iron.

No. 1.		No. 3.		No. 4.			Total.	
Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.		Tons.	Cwts.
489	0	189	15	35	16	=	634	12

NO. 7, AN ORDINARY FURNACE.

Coal.		Ores.		Limestone.	
Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.
1,145	6	1,071	2	375	14

Materials used per ton.

Cwt.	Cwt.	Cwt.
52	38·5	13·5

Production of Pig Iron.

No. 1.		No. 3.		No. 4.			Total.	
Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.		Tons.	Cwts.
333	3	196	16	25	13	=	555	12

The facts brought out in the above table prove that destruction of ores takes place in the open-top furnaces through the intensity of heat produced by the burning of the gas. This fact is known to exist in reverberatory furnaces, for part of the iron there passes off in a volatile condition. In the case of the hot blast, a similar occurrence is not to be wondered at, the temperature being sufficiently high to volatilize part of the crude materials during the process of reduction. It was at one time contended that the interior brickwork would never resist the action of the intense heat produced by the burning gas in the flues—where the temperature is fully equal to a heat competent to coke coal—and that the crossed arches in the interior of the furnace would give way, and the whole collapse. This had been proved an utter fallacy; the furnace is so constructed that the interior flues can be examined, as they have been from time to time, and up to the present date not the slightest change in the brick is apparent; and when we find brickwork similarly conditioned, such as in the lining of a blast furnace, from the boshes upwards, lasting (as in the case of the lower part in the present furnace) for fourteen years, there is not the slightest apprehension as to the durability of the fine brickwork. Altogether, Mr. FERRIE'S ingenious invention is, doubtless, destined to mark a new and important era in the manufacture of pig iron. A more prolonged series of testing will still more confirm the good results which are confidently anticipated of it. It is one of great interest to Scotch ironmasters. In Scotland alone, where the annual make of pig iron exceeds 1,000,000 tons, the saving effected in coal by this process amounts to 850,000 tons, representing in value £233,750, and in dross 400,000 tons, or equal in value to £40,000, exclusive of the estimated saving in ores also.

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ROSSITER W. RAYMOND, Ph. D., Editor.

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WESTERN & COMPANY,
Publishers,
37 PARK ROW,
NEW YORK CITY.

P.O. BOX, 5969.

A New Process for Cutting Hard Substances.

AT a recent meeting of the Franklin Institute, a new invention of considerable ingenuity was described and illustrated by the secretary of the Institute, Dr. W. H. WAHL. It consisted in cutting glass or any other hard substance by means of a current of air charged with ordinary quartz sand. The discovery was made, it appears, by Mr. B. C. TILGHAM, of Philadelphia, who in this way has succeeded in boring a hole an inch and a half in diameter and of the same depth, in twenty-five minutes, in a block of solid corundum. This substance ranks next in the scale of hardness to the diamond.

The original idea seems to have involved the use of a jet of high pressure of steam, but experiments showed that it was not necessary for all purposes to employ a very high pressure, and for such purposes as cutting and engraving glass a sufficient velocity could be easily attained by compressed air.

The process has been employed for removing the polish from glass, producing what is commonly called ground glass; and for mechanically engraving the skeletons of leaves or reproducing the figures in lace upon a glass plate. The former is accomplished by simply directing the current over the entire surface of the glass, and for this purpose a current capable of sustaining a column of water four inches in height may be employed and the surface rapidly ground. A blast one inch in diameter will prepare in this manner about five square inches of surface per minute. If a stencil plate of sufficient toughness and elasticity be laid upon the glass, it will, of course, protect the surface under it, and the form of the stencil will be left bright on the roughened surface, after the plate has been subjected to the action of the sand blast. It was found that paper, India-rubber, an oil paint, or even lace, were sufficiently tough for this purpose.

If "flashed" glass, or a plate which has received a thin film of colored glass on one side, be used, and the stencil plate be laid upon the colored side, the remainder of the flashing not protected may be removed, and the figure will be left in color on a white ground. By using a weaker air current, very delicate substances, such as green leaves, will offer sufficient resistance to the stream to prevent its affecting the glass beneath them; or by the proper regulation of the current, so that the smaller veins or ribs are cut through while the stouter ones remain intact, an effect may be produced closely resembling that of a shaded engraving.

The results obtained in this manner are accounted for upon the hypothesis that each grain of sand that strikes against the glass detaches a small fragment, while those that come in contact with the stencil, whether it be a copper plate, a piece of lace or a leaf, rebound from it because it is less brittle, though it may be much softer. The fact that in this way particles may be made to cut substances much harder than themselves, was shown by a hole being bored in corundum by a sand blast, above quoted, and also by a hole worn in quartz by small lead shot driven by a steam jet having fifty pounds to the inch pressure.

The application of this process to cleaning iron castings, such as the interior of pots which are to be tinned, has already been made with success, the irregular depressions in the surface being cleaned by this process as well as the more prominent portions, which alone are reached by the turning tool, unless a thick shaving be removed. The process will doubtless be found adapted to many other uses, and we hope that it may be as successful as it is ingenious.

The Poetry of the Past.

As a companion to the song of the Ichthyosaurus, which we presented to our readers a few months ago in English dress, a correspondent sends us the following excellent translation of another favorite burlesque ballad of the German students. We let it speak for itself; comment would be unnecessary, and perhaps indelicate:

A GUANO SONG.

FROM THE GERMAN: TRANSLATED BY T. C. P.

Air: *Ich weiss nicht was soll es bedeuten.*

Far off, in the tranquil ocean,
A peaceful coast I know;
Clear waves, with a lulling motion,
Round rocky ramparts flow.

No sail to the bay comes gliding,
No human foot to the strand;
Clean birds, in myriads, abiding,
Possess the lonely land.

They sit, a contemplative diet;
None fails of his task at the time:
Digestion with them is quiet,
And smooth as poet's rhyme.

These birds are philosophers truly,
Their cardinal maxim this:
The body keep open duly
And nothing can go amiss.

It grew through the silent hours,
The work by their fathers begun,
Till, now, like a mountain, it towers,
Refined by the tropical sun.

In rosiest light, their sages
Behold the future, and say:
"We'll build, in the course of the ages,
On every ocean and bay."

Their labors are lacking nowhere
Acknowledgment by the best:
The Böblinger turnip-grower
Thus speaks, in the Swabian west:

"Long live, in your distant dominions,
Ye excellent birds, secure!
Our Hegel creates opinions,
Ye make a sterling manure!"

Arizona.

ADVICES from this territory continue favorable. The excitement in regard to the new silver mines in the vicinity of the Bradshaw mountain is reported on the increase. A lot of ore, weighing 500 pounds, and brought into Prescott from the "Tiger," is reported as yielding at the rate of 1800 ounces of silver per ton, and we are assured at the same time that the ore was taken from the ledge by a miner who is unable to select good ores simply because he does not know them. About one hundred men were in the new district, according to the latest advices, and several large parties were fitting out to go there immediately. A town had been laid out near the vein on a creek, and several of the merchants of Prescott contemplated removing their business to the new mines. It was confidently expected that the district would contain a population of 5000 early in the spring. It should be mentioned that the "Tiger" had been traced for three miles, and that a number of other veins, equally rich, had been found.

From the Sacramento district, near Fort Mohave, regular shipments of ore were to be commenced in a few weeks.

The news from the Vulture is as flattering as it has been for the last six months. The lowest level contains exceedingly rich ores, which are hauled to the mill unassorted.

Advices from the Big Bug mine represent that a new body of decomposed ore has been found, which is said to be richer than any similar ore ever found in Arizona.

We are sorry to be at the same time informed that the Apaches have of late shown increased activity in the middle portions of the Territory. But perhaps this is necessary to stimulate more vigorous action on the part of the military authorities, and to rid the country the sooner of these pests.

The Taxation of Mines.

WE publish in another column a letter from an intelligent mining superintendent of California, on the subject of the mining titles acquired under tax sales, which well deserves thoughtful consideration. The question of the propriety of taxing as property, under State laws, possessory mining claims is not discussed in this letter; but our correspondent addressed, in 1869, to the *Scientific Press*, of San Francisco, a forcible argument on that point, from which it appears that the practice of such taxation in California is quite recent, and lacks, to say the least, the sanction of explicit legislation. It took its rise, doubtless, in a jealousy on the part of the agricultural and other interests towards mining. It seemed unjust to ranchmen and merchants that the miner, who is endowed with special privileges by law, should be exempt from contributions to support the government that protects him.

Moreover, it was found that the exemption of mining claims from taxation prevented the purchase of mineral lands from the Government, under the mining patent law. Men enjoying already the possessory rights did not care to pay for proprietary ones the price of the patent fees and the annual tax which would thus be levied on their real estate. The only way to induce mine claimants to enter the class of mine owners is to make it worth their while to do so. This the United States law does, by giving them a title superior to the changing local custom; but this advantage is counterbalanced, if by the simple expedient of not applying for patents, the miners can escape the payment of taxes. A government patent under the present law may appear to the miner not to be worth the payment of the fees and the subsequent annual taxation.

But we have at present nothing to do with the wisdom or legality of such taxation. The burden of our correspondent's letter is, that the United States shall declare whether the mineral lands occupied, but not patented, shall be subject to State taxation or not. Let us have certainty, at all events.

With this view we agree; but we do not think Federal legislation is required to effect the desired result. The case is like a thousand others that arise in daily business. It should be settled by the courts; and when these, in succession, up to the tribunal of highest authority, have passed upon it, there will be no further difficulty in knowing whether tax titles, right or wrong, are legal.

Even if further legislation is required, it should not be Federal. Congress does not undertake to direct the several States in the matter of taxation. It seems to us that the State of California has a perfect right to tax, if it chooses, not, indeed, the mineral land which belongs to the public domain, but the easement held under the United States law by the mining claimants. The practical difficulty is that of valuation. If Senator STEWART'S bill becomes a law, a mining claim will represent a certain area; and, previous to the procurement of a patent for it, it might, during its undeveloped state, be valued at $5 per acre, the United States price.

It will be seen that the question is beset with difficulty on either hand; and that, of itself, is good reason for leaving it to the States, and not attempting to settle it by an iron, universal rule.

Montezuma District, Nye County, Nevada.

THIS district seems to be destined to be added to those that have become of special importance. Favorable accounts in regard to it have reached us from time to time, and those received lately are highly satisfactory.

The great success of Messrs. MCGLEW and DAWLEY has notably contributed to the prosperity of the district at large. The first-mentioned gentleman was formerly connected with the Twin River Company as engineer, and is considered a very accomplished mechanic. The firm some time ago bought a ten-stamp mill, known as the Falkner, at Yankee Blade. With the help of fourteen laborers and two brick masons they moved this mill to the Montezuma district, one hundred and forty miles, sawed fifty thousand feet of lumber, put the mill, including three reverberatory furnaces, in running order, and had a retort of bullion ready to melt in just three months and two days. This is the quickest and most successful work ever done in the State of Nevada, in that line, and it is almost entirely due to the great energy and business talent of Mr. MCGLEW. If our eastern companies, who failed in so many instances in their mining enterprises out West, had had such men at the head of their works, their investments might have made fortunes for them ere now. Messrs. MCGLEW and DAWLEY are already on the high road to complete success, and according to present appearances, their business will soon be, considerably extended. The product from their ten-stamp mill for the month of January was, according to reliable advices from Austin, $20,000. But Mr. MCGLEW contemplates erecting a second mill at or near Park Cañon in Smoky Valley, which he intends to run altogether on custom work, and thus to double his profits. As many good lodes have of late been discovered in the Montezuma district and Smoky Valley, it is more than likely that Mr. MCGLEW'S second enterprise will also prove a success.

As an instance of valuable new discoveries in the Montezuma district, we mention the Burmahan, lately discovered by Mr. RYAN. He was offered $40,000 in coin for the original, but he does not seem to have accepted the offer. Messrs. CONLIN & DUNN, we are informed, sold the first extension of the claim for thirty thousand dollars coin, to Mr. P. LYONS, of Austin, and Mr. JOSEPH EVANS, according to the same authority, bought the second extension for fifteen thousand dollars. About 600 persons now live in the district, and a town site has been surveyed and laid out by Messrs. MCGLEW and DAWLEY.

Weisbach.

WE have, at the moment of going to press, received from a private source the news of the death of our former instructor and friend, the Oberbergrath, Professor JULIUS WEISBACH, at Freiberg, Saxony, on the morning of the 24th of February.

Professor WEISBACH was well known to the entire engineering world by his works on mechanics and engineering. The news of the death of this great and good man will bring sorrow to all those whose good fortune it has been to have studied under him, and his loss is indeed a great one to the scientific world. At present we have neither time nor space for a more extended notice, which we are compelled to defer till our next issue.

New Publications.

THE GAS SUPERINTENDENT'S POCKET COMPANION for the year 1871. By HARRIS & BROTHER, Gas Meter Manufactuers, No. 1115 and 1117 Cherry street, Philadelphia. Philadelphia: HENRY CAREY BAIRD, Industrial Publisher, 406 Walnut street, 1871. Price $2.

THIS book, besides containing, in convenient pocket form, many tables and formulæ of primary necessity to an engineer or superintendent of gas-works, has much information, chiefly arranged in tabular form, or in the shape of formulæ, valuable for all engineers. Among these we may mention the tables of squares and cubes; diameters, circumferences and areas of circles; the weights of iron—flat, round and square; the weight and strength of round and flat wire, flat and hemp rope and chains; together with much information concerning retorts and pipes of various kinds, and the motion of gases through them.

Estimation of Phosphorus in Crude Pig-Iron, in Steel, and in Malleable Iron.

By F. KESSLER.

THE methods at present in use for the separation of phosphorus from iron by the moist way are based either upon the formation in an alkaline fluid of an insoluble combination of one of the two bodies, leaving the other dissolved, or on precipitating the phosphorus in an acid solution; the molybdic acid method belongs to the second class, and this method, as improved by various authors, is well suited for the requirements of the industrial estimation of phosphorus in iron, although it is troublesome and tedious. This last-named defect induced me to commence experiments with the view to find out whether it would not be possible to find a method of removing iron, and the other metals it is accompanied with, from an acid solution, and to estimate the phosphorus afterwards.

Starting from the well-known reactions of the two salts, commonly known as yellow and red prussiates, containing iron in the two conditions of ferrosum and ferricum, experiments were instituted in this direction, and, after some preliminary investigation, I found that I should be limited to the use of the following reaction:

$$FeCl_2 + K_4FeCy_6 = 2KCl + K_2Fe_2Cy_6$$

If it be supposed that 1 per cent. of phosphorus in iron is indicated by the production of 1 decigrm. of pyrophosphate of magnesium, and, since that salt contains 27·93 per cent. of phosphorus, it is evident that we have to take a quantity of 2·793 grms. of crude iron to experiment upon. As, however, a filtration from a bulky precipitate is required, it is preferable to double the quantity of metal, and weigh off 5·6 grms. This quantity of metal, after solution in acid, requires no less than 42 grms. of crystallized ferrocyanide of potassium, and the ensuing precipitate will weigh at least 34 grms., exclusive of chemically combined water.

This fact sufficiently indicates the necessity of a correction in reference to the bulk of this precipitate, and since I could not find any published account on the specific bulk and gravity of this precipitate, I made a series of experiments, taking care to adjust the proportions according to the plan devised and indicated above. I dissolved 11 grms. of soft iron wire in hydrochloric acid, and 84 grms. of ferrocyanide of potassium in water, taking care to dilute each of these solutions to 500 c.c.; the specific gravity of the iron solution was equal to 1·055, while that of the ferrocyanide solution was found to be equal to 1·093. 250 c.c. of each solution having been taken, were mixed in a flask holding 500 c.c., and the joint bulk found to be equal to 505 c.c., the liquid was filtered, care being taken *not* to wet the filter previously; the specific gravity of the filtrate was found equal to 1·053. From this the bulk of the liquid is calculated according to the following equation:

$$250\ (1{\cdot}055 + 1{\cdot}093) - 34 = 503 \text{ grms,}$$

and the bulk of the precipitate:

$$505 - \frac{503}{1{\cdot}033} = 18 \text{ c.c.}$$

It hence follows that, in order to take 250 c.c. filtrate as the half of the total, the liquid mixed with the precipitate has to be previously diluted to 518 c.c. But this quantity may be varied from 517·5 to 518·5, according to the variable quantity of pure metal present in 5·6 grms. of crude iron as compared with the quantity of pure iron present in the 5·5 grms. of iron-wire solution just alluded to. Since I employed in my experiments the large crystals of the ferrocyanide of potassium as met with in commerce, it became necessary to ascertain the quantity of phosphates or other impurities present in the salt, and the amount thereof in the quantity constantly to be used, so as to eliminate this source of error altogether, or to take it into account. This was done in the following manner: A measured quantity of chloride of iron, containing 5·58 grms. of iron, and absolutely free from any phosphorus, was mixed with the ferrocyanide solution, and further treated (the full description of my method I will give presently) for phosphorus by the pyrophosphate of magnesium method. Instead of obtaining, however, that salt, I got a small quantity of a yellow-colored, flocculent substance, which, including the ash of the filter, left, after ignition, a quantity of 1 milligrm., and, consequently, instead of taking the quantity of the filter ash at 0·0005 grm., I took it during my experiments at 0·0010 grm.

Take 56 decigrms. of crude iron, previously suitably broken up—for cast-iron the substance should be passed through a sieve the meshes of which are 0·5 m.m. apart—put the metal into a porcelain crucible, 11 centims. diameter at the top, and a depth of 13 centims., and provided with a handle and spout (a so-called casserole), and add to the metal 60 c.c. nitric acid, sp. gr. 1·2, taking care to cover the vessel with a large-sized watch-glass. After the first violent action has subsided, the crucible is gently heated, so as to cause the slow evaporation of the nitric acid; when, after the lapse of about one and a half hours, the materials contained in the crucible begin to get rather thick, the vessel is uncovered, and heated more strongly over an argand burner, care being taken to prevent spirting by the moving about of the crucible. As soon as the mass is dry, the handle of the crucible is fastened in a suitable manner, so as to admit of the crucible and contents being heated to very bright redness (if a muffle is at hand it answers the purpose best); after the cooling of the vessel, its contents are transferred to a platinum crucible. After the ignition of the materials in the platinum crucible, to oxidize the carbon, they are again transferred to the porcelain crucible, and therein treated at a gentle heat with 35 c.c. of hydrochloric acid, sp. gr. equal 1·19, until the whole of the substance in the vessel, excepting some perfectly colorless silica, is dissolved. The method of dissolving the metal here described does away with the separate treatment of any phosphorus-containing residue, in the case of nitrohydrochloric acid being employed for the solution of the metal. The acid solution obtained, as just mentioned, is poured, without any previous filtration, into a flask of at least 518 c.c. capacity, and diluted to about 200 c.c. A caoutchouc plug is next placed into the neck of the flask, care being taken to have the plug perforated with two holes, through one of which a glass rod is passed, so as to admit of being used as a valve, while through the other hole a glass tube is passed, which is let down through the neck of the flask just until it reaches the wider part of the flask; the tube is, by a suitable means, put into communication with a self-acting sulphuretted hydrogen apparatus. The sulphuretted hydrogen gas having been turned on, the operator opens the valve by removing the glass rod from the plug, and shakes the flask, taking care not to spill any liquid; this operation is continued until the reduction of the iron and precipitation of the copper, or any other metals precipitable by sulphuretted hydrogen, become apparent, as shown by the running together of the sulphur to small globules, and the brownish color imparted to the liquid. This method of reduction is more rapidly and readily effected than the reduction by means of a sulphide.

The next operation consists in pouring into the flask 200 c.c. of an aqueous solution of ferrocyanide of potassium, prepared so as to contain 210 grms. of the crystallized salt in 1 litre. The contents of the flask are next diluted to 518 c.c., and the liquid filtered through ordinary dry filtering-paper, folded as usual, the diameter of the filter being 27 centims., the funnel to be covered with a glass plate. The filter is at once filled to the rim, so as to moisten the paper thoroughly. The turbid liquid which at first passes through (about 20—30 c.c.) is separately collected, and after the turbidity subsides, the filtrate is collected into the 250 c.c. flask.

The filtration is relatively the most tedious portion of the entire process, since it takes nearly an hour and a half. When a quantity of 250 c.c. of the liquid has been collected in the flask, its contents are poured into a beaker-glass, into which are previously poured 10 c.c. of a solution of sulphate of magnesium, of a strength of 200 grms. to the litre, and strong liquid ammonia in excess. For the proper separation of the ammonio-phosphate of magnesium, the liquid is left standing at least over night.

The operator will observe that the salt just alluded to is always covered with a grayish-colored flocculent substance; but, without troubling about the nature of this impurity, which is completely removed by a subsequent operation, the manipulator brings the ammonio-phosphate of magnesium (as it does not adhere to the sides and bottom of the beaker-glass) and the body just alluded to, on a small filter, washes it somewhat with liquid ammonia of 9·08 sp. gr., and next dissolves the salt adhering to the sides of the beaker, and also that contained on the filter, in nitric acid of 1·035 sp. gr. There will remain on the filter an insoluble and blue-colored cyanogen compound. To the nitric acid solution, liquid ammonia in excess is added, and, after the complete separation of the pure ammonio-phosphate of magnesium, it is collected on a small filter, washed with liquid ammonia of 0·98 sp. gr., until, on testing, no more chlorine is detected, it is next dried and ignited.

After deduction of the weight of the ash of the filter and the impurity above alluded to (in the author's mode of operation, amounting to 0·0010 grm.), every decigramme of ignited pyrophosphate of magnesium amounts to 1 per cent., or, more correctly, to 0·9975 per cent., of phosphorus.

The author and inventor of this method states that a lengthy series of comparative experiments made by him have proved that the method just described is in every respect correct, and suitable for all practical purposes, and applicable to the proper estimation of phosphorus in crude pig-iron, steel and malleable iron. He considers it to be preferable to the molybdic acid method.—*Journal für Praktische Chemie.*

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112,527, antedated February 28, 1871.—GARDEN HOE.—John P. Avery, Norwich, Conn.
112,528.—CARRIAGE PERCH.—Isaac Preston Bacon, Bedford, Mass.
112,529.—CHIMNEY CAP.—Thomas D. Bailey, Lowell, Mass.
112,530.—HARVESTER.—Lindley M. Batty, Canton, Ohio.
112,531, antedated February 28, 1871.—FEEDING MECHANISM FOR SEWING MACHINES.—Robert M. Berry, Brooklyn, N. Y.
112,532.—FRUIT-DRIER.—Jacob S. Biddle and Theodre S. Lingenfelter, Pattonville, Pa.
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112,537.—OIL-CAN HOLDER.—William Stoddard Brick, Fitchburg, Mass.
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112,549, antedated March 9, 1871.—CLIP FOR BUGGY SPRINGS.—
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112,555.—HEATING STOVE.—William Cottingham and John W. Stafford, Troy, Ohio.
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112,558.—BITTERS.—Antoine Desaulniers, Oswego, N. Y.
112,559.—WAGON BOX AND HAY RACK.—Samuel Dickson, Sandwich, Ill.
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112,664.—COPY-HOLDER.—Henry R. Williams, Buffalo, N. Y.
112,665.—CARRIAGE-BRAKE.—August Wnuck, Cincinnati, Ohio.
112,666.—BLIND-SLAT MACHINE.—George F. Woolston, Washington, D. C.
112,667.—WATER-WHEEL.—Pierce W. Yarrell, Littleton, N. C.
112,668.—ROLL FOR FORMING HORSE-SHOE BLANKS.—William Acheson, Pittsburg, Pa., assignor to Charles L. Fitzhugh, same place.
112,669.—CLOTHES-WRINGER.—August Albrecht, Philadelphia, Pa.
112,670.—RAILROAD-STATION INDICATOR.—Granville W. Alexander, Chicago, Ill.
112,671.—RAILROAD-STATION INDICATOR.—Joseph Bell Alexander, Washington, D. C.
112,672.—FENCE.—William Altick and Francis P. Grimes, Dayton, Ohio, assignors to Wilson & Grimes, same place.
112,673.—DOOR-CHECK.—Charles R. Anderson, St. Louis, Mo.
112,674.—VENTILATING MILK CAN.—Lauren B. Arnold, Lansing, N. Y.
112,675.—BENCH-PLANE.—Joseph R. Bailey, Woonsocket, R. I., assignor to himself and Selden A. Bailey, same place.
112,676.—ROTARY HARROW.—John W. Barton and Thomas Holmes, Emporia, Kansas.
112,677.—HAT-PRESS.—Samuel Beatty, Norwalk, Conn.
112,678.—SEWING-MACHINE.—Joseph Bennor, Philadelphia, Pa.
112,679.—LOOM.—William H. Boozer, Potter's Mills, Pa.
112,680.—CARVING-TOOL.—Myron T. Boult, Battle Creek, Mich.
112,681.—HOOP SKIRT.—Morris P. Bray, Birmingham, Conn., assignor to himself and Downs & Bassett, same place.
112,682.—SAWING-MACHINE.—George W. Braymer, Penn Township, Mich.
112,683.—CLASP FOR ARTIFICIAL LIMBS.—Samuel F. Burd, Mercer, and Joseph F. Denniston, Pittsburg, assignors to Artificial Limb Manufacturing Company, Pittsburg, Pa.
112,684.—STEAM VALVE.—Adam S. Cameron, New York, N. Y.
112,685.—PISTON-PACKING.—Adam S. Cameron, New York, N. Y.
112,686.—FURNITURE PAD.—David H. Clark and Henry Winson, New Haven, Conn.
112,687.—FANNING-MILL.—George E. Clarke, Racine, Wis.
112,688, antedated March 3, 1871.—ROTATING CYLINDER ENGINE.—Robert Livingston Cohen, Philadelphia, Pa., assignor to himself and William D. Lance, Plymouth, Pa.
112,689.—CUTTING APPARATUS FOR HARVESTERS.—George W. Cook, Geneseo, and Francis M. Duncan, Aledo, Ill.
112,690.—GRAPPLE.—Edwin G. Crandal, Belfast, N. Y.
112,691.—MOLDING-MACHINE.—James H. Culver, San Francisco, Cal.
112,692.—HARVESTER-CUTTER.—Henry Cutler, Central Village, Conn.
112,693.—LOCKING STOP-COCK.—Ellwood Davis and Jacob M. Stiles, Camden, N. J.
112,694.—BREECH-LOADING FIRE-ARM.—William C. Dodge and Philip T. Dodge, Washington, D. C.; said Philip T. Dodge assigns his right to said William C. Dodge.
112,695.—SPRING-SEAT FOR WAGONS.—Willoughby P. Elam, Petersburg, Ill.
112,696.—CHILD'S CARRIAGE.—Roscoe G. Elder, New York, N.Y.
112,697.—LADDER.—George Henry Ellis, London, England, assignor to Augustus Salem Dimsdale and Edward Bovine Lovell, same place.
112,698, antedated March 7, 1871.—FURNACE FOR TREATING ORES, &c.—William Ennis, Philadelphia, Pa.
112,699.—MECHANICAL MOVEMENT.—William A. Fenn, Rochester, N. Y.
112,700.—GRAIN-DRILL.—Silas N. Gallup, Macedon, N. Y.
112,701.—ALE OR BEER-COCK.—Henry Getty, Hoboken, N. Y.
112,702.—MACHINE FOR MAKING BOOT AND SHOE-HEELS.—Charles W. Glidden, Lynn, assignor to McKay Heeling-Machine Association, Boston, Mass.
112,703.—STAINING GLASS.—Ebenezer A. Goodes, Philadelphia, Pa.
112,704.—ELECTRO-MAGNETIC BURGLAR-ALARM.—William B. Guernsey, Jersey City, N. J.
112,705.—ELECTRO-MAGNETIC BURGLAR-ALARM.—William B. Guernsey, Jersey City, N. J.
112,706.—ELECTRO-MAGNETIC BURGLAR-ALARM.—William B. Guernsey, Jersey City, N. J.
112,707.—DOUGH-KNEADER.—Herbert Henry Hawes, Mount Meridian, Va.
112,708.—SWING.—Francis Hovey, Ipswich, Mass., assignor to himself and John Albert Brown, same place.
112,709.—TRUSS.—Henry Howe, Council Bluffs, Iowa.
112,710.—CONFECTIONER'S MOLD.—Henry S. Howe, Rutland, Vt.
112,711.—SAW-GUMMER.—David Huffman, Luray, Va.
112,712.—SHOW-CASE.—John A. Hughes, Somerville, assignor to John A. Hughes & Co., Boston, Mass.
112,713.—PAD FOR HORSE-COLLARS.—Lemuel L. Hull, Oskaloosa, Iowa.
112,714.—FIRE-ESCAPE.—John Ivory, New York, N. Y.
112,715.—DRAFT-EQUALIZER FOR THREE HORSES.—Henry F. Jerauld, Vandalia, Ill., assignor to Jerauld & Stolle, same place.
112,716.—BEDSTEAD.—George A. Jeremiah, New York, N. Y.
112,717.—WINDOW-BUTTON.—Albert D. Judd, New Haven, Conn.
112,718.—BRUSH.—David L. Keeler, Norwalk, Ohio.
112,719.—MACHINE FOR MAKING AND SETTING BLIND STAPLES.—Jeremiah Keith, Charlton, Mass.
112,720.—TREADLE-MOTION.—Eben B. Keyes, Charlestown, Mass.
112,721.—MACHINE FOR CUTTING SPLITS.—Ebenezer Knight, Elizabeth, Ind., assignor to himself, Rufus S. Mitchell, and Edward S. Compton, same place.
112,722.—METER.—Albert D. Laws, Bridgeport, Conn.

REISSUES.

4,295.—HARNESS-RING.—Horace N. Eames, Newport, assignor to Hiram R. Olmstead and Richard W. Jones, Syracuse, N. Y.—Patent No. 100,384, dated March 1, 1871.
4,296.—CARPET-LINING.—Joel F. Fales, Walpole, Mass.—Patent No. 52,835, dated February 27, 1866.
4,297.—ELECTRO-MAGNETIC BURGLAR-ALARM.—William B. Guernsey, Jersey City, N. J., assignor to Cyrus B. Martin, Newburg, N. Y.—Patent No. 108,257, dated October 11, 1870.
4,299.—DEVICE FOR CUTTING BOLTS AND RIVETS.—Jesse Johnson, Cochranesville, Pa.—Patent No. 65,391, dated June 4, 1867.
4,300.—MAKING THICK PAPER.—Samuel G. Levis, Kellysville, Pa., assignor to James C. Beach.—Patent No. 19,519, dated February 74, 1854; reissue No. 2,789, dated October 22, 1867; extended seven years.
4,301.—STEAM GENERATOR.—Abraham L. Pennock, Philadelphia, Pa.—Patent No. 103,353, doted May 24, 1870.
4,302.—STEAM BOILER.—Patrick Quinn, South Newmarket, N. H.—Patent No. 110,158, dated December 13, 1870.
4,303.—BUTTON-HOLE.—Benjamin M. Smith, New York, N. Y. Patent No. 75,212, dated March 3, 1868.
4,304.—LAMP.—Lewis White, Waterbury, Conn., assignor, through mesne assignments, to Rufus S. Merrill, Boston, Mass.; said Rufus S. Merrill assignor of two-thirds of his right to William B. Merrill, same place.—Patent No. 25,475, dated September 13, 1859.

DESIGNS.

4,700.—ORGAN-CASE.—Charles Edwin Bacon, Buffalo, N. Y., assignor to himself and George A. Prince.
4,701.—HAME-TOP.—Mathew F. Boland, Philadelphia, Pa.
4,702.—MUFF.—Simon Herzig, New York, N. Y.
4,703.—FRAME OF A SHOW-CASE.—Benjamin Hill, Malden, Mass.
4,704.—STOCKING.—James Hogg, Philadelphia, Pa., assignor to Fleming Brothers, same place.
4,705.—INKSTAND.—Thomas S. Hudson, East Cambridge, Mass.
4,706.—SAW.—William Kidd, Duncan's Mills, Cal.
4,707.—ORNAMENTATION OF GLASS-WARE.—Frederick Ladner, Philadelphia, Pa., assignor to Ladner & Bird, same place.
4,708.—FASTENING FOR BEDSTEAD.—William H. McPherson, Nashville, Tenn., assignor to himself and William N. Carr, Sr., same place.
4,709.—GARDEN-TOOL.—Roswell A. Moore, Kensington, Conn.
4,710.—SPOON OR FORK-HANDLE.—William Parkin, Taunton, Mass., assignor to Reed & Barton, same place.
4,711.—FLOOR OIL-CLOTH PATTERN.—Joseph Robley, Brooklyn, N. Y., assignor to William M. Brasher & Co., same place.
4,712.—FLOOR OIL-CLOTH PATTERN.—Joseph Robley, Brooklyn, N. Y., assignor to William M. Brasher & Co., same place.
4,713.—FLOOR OIL-CLOTH PATTERN.—Joseph Robley, Brooklyn, N. Y., assignor to William M. Brasher & Co., same place.
4,714.—GROUP OF STATUARY.—John Rogers, New York, N. Y.
4,715.—SPOON OR FORK HANDLE.—George Sharp, Philadelphia, Pa.
4,716.—BACK OF MITTEN.—William S. Tooker, Kingsborough, N. Y., assignor to himself and Elliot Thomas, same place.
4,717.—CARPET-PATTERN.—John T. Webster, New York, N. Y., assignor to Daniel M. Read and Charles A. Read, Bridgeport, Conn.
4,718.—PAINT-BRUSH.—John L. Whiting, Boston, Mass.
4,719.—SPOON OR FORK-HANDLE.—George Wilkinson, Providence, R. I., assignor to Gorham Manufacturing Company, same place.
4,720.—INKSTAND.—Lucius L. Woodruff, Cleveland, Ohio.

TRADE-MARKS.

188.—BOOT-HEEL.—Francis Hacker & Frederick Richardson, Providence, R. I., assignors to "Reversible Boot-Heel Company," same place.
189.—SOAP.—Leberman & Co., Philadelphia, Pa.
190.—DRESSING COMPOUND.—E. R. Millard, Waltham, Mass.
191.—WHISKY.—Mills, Johnson & Co., Cincinnati, Ohio.
192.—WHISKY.—Mills, Johnson & Co., Cincinnati, Ohio.
193.—WHISKY.—Mills, Johnson & Co., Cincinnati, Ohio.
194.—WHISKY.—Mills, Johnson & Co., Cincinnati, Ohio.
195.—SIRUP.—William Moller & Sons, New York, N. Y.
196.—GRAY CLOTH.—L. Pomeroy's Sons, Pittsfield, Mass.

EXTENSIONS.

FRANKLIN N. CLARKE, of New Haven, Conn., administrator of ELIZUR E. CLARKE, deceased.—Letters Patent No. 16,719, dated March 3, 1857.

C. F. HUTCHINS, of East Douglas, Mass., administrator of CHARLES HUTCHINS, deceased.—Letters Patent No. 16,732, dated March 3, 1857.

The Toughness of Iron at Different Temperatures.

ON our first page will be found the article of Mr. WILLIAM BROCKBANK on the effects of cold on iron and steel, which was crowded out of our columns last week, although we published the answers of Messrs. FAIRBRAIN and JOULE. Without going deeply into the merits of the subject, we must remark that the results of the experiments by Mr. BROCKBANK are more in accordance with the general experience of engineers in cold climates, and at the same time were made on a scale which entitles them to more consideration from practical men than the experiments on *garden-nails* (whatever they may be) by so eminent a scientist as Mr. JOULE.

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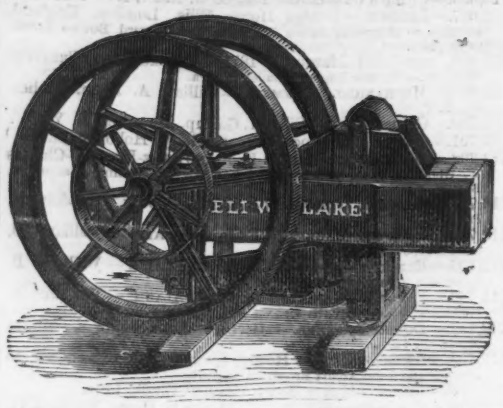

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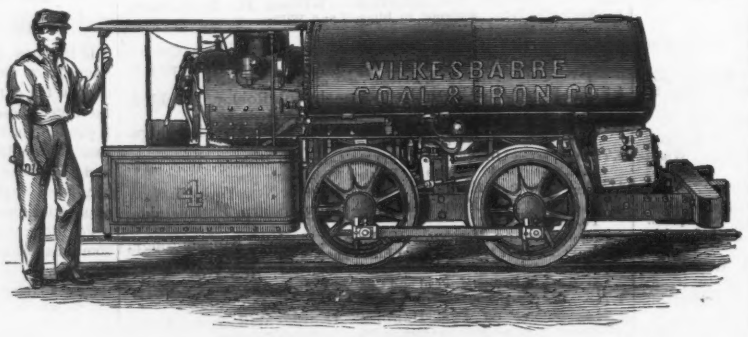
Jun28:1y



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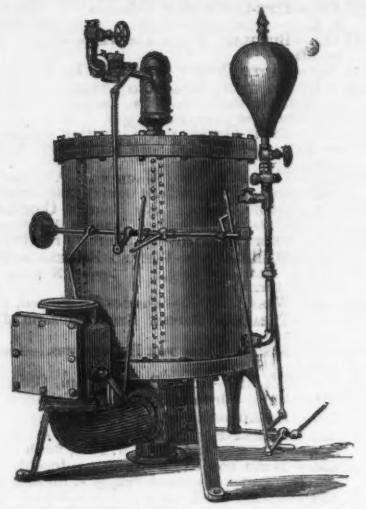

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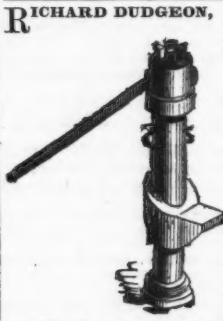

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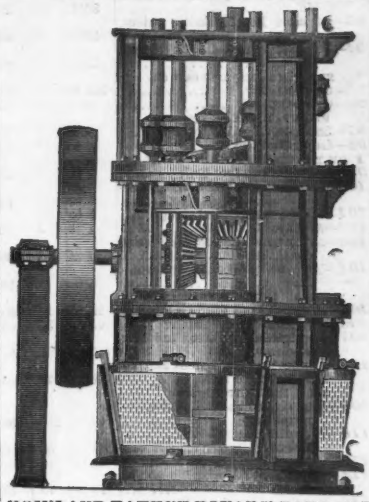

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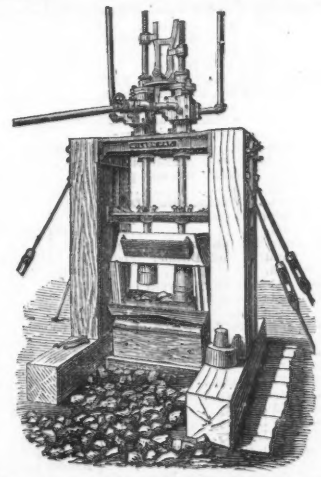

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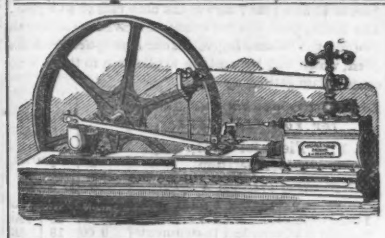

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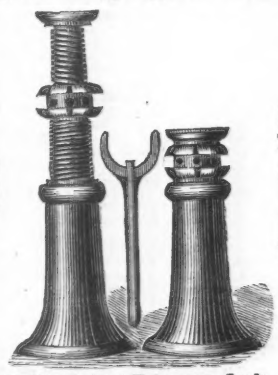

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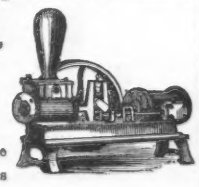

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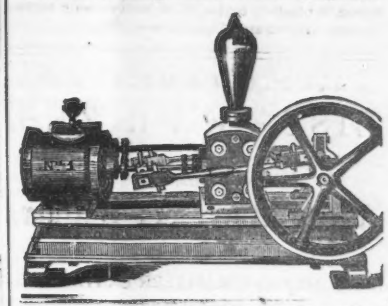

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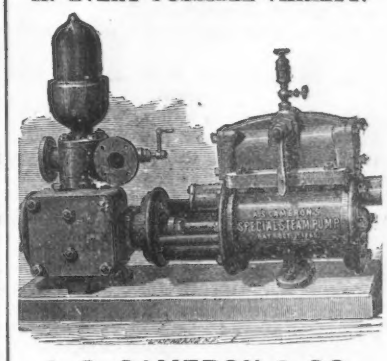

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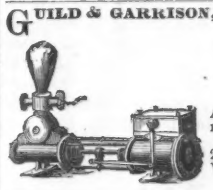

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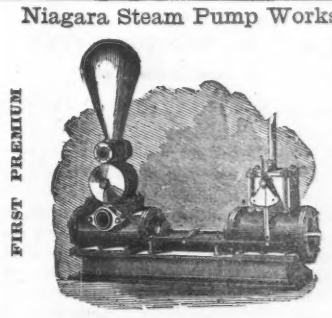

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76	Auger-Bits, your choice of 4 sets	— —	—	—
	FROM L. W. POND.			
77	Foot-Lathe, No. 1	50 00	65	204
78	Foot-Lathe, No. 2	30 90	47	124
	FROM COLBY BROS. & CO.			
79	Miniature Steam-Engine and Boiler	1 36	5	23
	FROM RUSSELL & ERHR.			
80	Steam-Engine (1 H. P.) and Boiler	300 00	310	1125
81	Steam-Engine (3 H. P.) and Boiler	600 00	640	3250
82	Steam-Engine (5 H. P.) and Boiler	800 00	858	3000
83	Steam-Engine (10 H. P.) and Boiler	1200 00	1285	4500
84	Steam-Pump, C. B. Hardick's, No. 0	120 00	155	540
85	Steam-Pump, Cameron & Co.'s, No. 1	150 00	192	675
86	Steam-Pump, Cameron & Co.'s, No. 2	200 00	257	900
87	American Submerged Pump	12 00	19	65
	FROM GEORGE TALLCOT.			
88	Turbine Water-Wheel, Reynold's, 12 in.	105 00	125	360
89	Turbine Water-Wheel, Reynold's, 24 in.	226 50	270	800
90	Turbine Water-Wheel, Reynold's, 36 in.	384 50	460	1350
91	Rotary Blower, Root's patent, No. 1	$50 00	70	275
92	Rotary Blower, Root's patent, No. 2	80 00	105	420
93	Portable Forge, Root's patent, No. 1	48 00	65	260
94	Portable Forge, Root's patent, No. 3	80 00	105	420
	FROM THE AMERICAN SAW CO.			
95	Circular Saw	125 00	135	473
96	Cross-Cut Saw	6 60	14	42
	FROM A. P. & M. STEPHENS.			
97	Labor-Saving Vise, 2-in. jaw	4 00	9	32
98	Labor-Saving Vise, 4½-in. jaw	12 00	28	58
	FROM THE STANLEY RULE & LEVEL CO.			
99	Boxwood two-foot Rule	2 50	6	25
100	Silver-Plated Triangular Drawing-Scale	6 00	16	52
101	Pocket Sheet-Metal Gauge	5 00	13	37
102	Arkansas Oil-Stone	1 75	5	22
103	Arkansas Oil-Stone, mahogany case	3 25	8	30
104	Gear or Cog-Wheel Calculating-Rule	4 00	12	36
	WESTERN & COMPANY'S AGENCY.			
105	Preparing and Filing a Caveat.	25 00	28	80
106	Application for a Patent	30to40	35	100
107	Application for Patent and first Government fee	46to56	50	150
108	Application for Patent and all Government fees	66to76	75	250
	FROM J. W. HUTCHINSON.			
109	English Breech-loading double-barrel Gun	100 00	110	350
110	English Muzzle-loading double-barrel Gun	75 00	85	250
111	Breech-loading Rifle, the Allen	30 00	46	150
112	Revolver, Smith & Wesson's, No. 1½	12 50	19	65
113	Revolver, Smith & Wesson's, No. 2	15 00	22	75
	FROM MASON & HAMLIN.			
114	Melodeon, portable, No. 1, 4 octave	50 00	66	200
115	Melodeon, resonant, style G, 5 octave	170 00	146	510
116	Pipe-Organ, church use, style No. 29	675 00	579	2000
	FROM J. S. & C. ODELL.			
117	Pipe-Organ	500 00	430	1500
118	Pipe-Organ	700 00	600	2100
119	Bradbury Square Piano-Forte, No. 4	650 00	430	1500
120	Steinway's No. 1 Grand Piano	1200 00	860	3000
	THE AMERICAN WATCH CO., WALTHAM, MASS.			
121	Silver Watch	20 00	32	100
122	Silver Watch	35 50	48	142
123	Gold Watch	50 00	65	200
124	Lady's Gold Watch	100 00	110	350
	FROM THE UNITED STATES WATCH CO.			
125	Silver Watch	40 00	50	150
126	Silver Watch	66 00	75	275
127	Gold Watch	100 00	100	300
128	Silver Watch	104 00	104	312
129	A Sewing Machine (your choice)	65 00	65	209
	FROM MCALLISTER.			
130	Microscope and 48 objects	10 00	14	40
	FROM COLBY BROS. & CO.			
131	Velocipede for Boys	16 00	16	52
	FROM MCALLISTER.			
132	Magic-Lantern, No. 433	20 00	30	95
	FROM H. THOMPSON.			
133	An Easy Chair			
	FROM D. APPLETON & CO.			
134	New American Cyclopædia, 16 vols	80 00	80	213
	FROM G. & C. MERRIAM.			
135	Webster's Unabridged Pictorial Dictionary	12 00	15	45
136	Webster's National Pictorial Dictionary	6 00	10	35
	FROM WESTERN & COMPANY.			
137	One back vol. Manufacturer and Builder, unbound, post-paid	1 75	6	25
138	Two back volumes Manufacturer and Builder, unbound, post-paid	3 50	11	37
139	One back vol. Manufacturer and Builder, bound, post-paid	2 50	9	32
140	Two back volumes Manufacturer and Builder, bound, post-paid	5 00	18	58
141	Cover for binding the Manufacturer and Builder, post-paid	60	3	21
142	A $10 Library (your choice from list in special sheet),	10 00	18	58
143	A $15 Library, "	15 00	24	85
144	A $20 Library, "	20 00	31	106
145	A $25 Library, "	25 00	38	125
146	A $30 Library, "	30 00	44	144
147	A $35 Library, "	35 00	50	162
148	A $40 Library, "	40 00	56	177
149	A $45 Library, "	45 00	62	192
150	A $50 Library, "	50 00	68	207
151	A $60 Library, "	60 00	80	237
152	A $75 Library, "	75 00	100	282
153	A $100 Library, "	100 00	125	360

All paid through by mail or express.

154	A choice of good Books (see terms in another column)			
155	A choice of convenient Book-Cases (see special sheet)			
156	A choice of popular Music (see terms in special sheet)			
157	A choice of Games and Toys, (see terms in special sheet)			

We have taken especial pains to select in making up our price list the NEWEST and very BEST articles. No charge will be made for boxing or packing any article on our list. The Premiums, Nos. **4** to **7** inclusive, **31** to **35** inclusive, **79**, **99**, **101**, **105** to **108** inclusive, **121** to **128** inclusive, **137** to **141** inclusive, **154**, **156**, **157**, will each be delivered FREE of charge by mail or express (at the Post-office or express office nearest recipient) to any place in the United States or Territories. The other articles cost the recipient only the freight after leaving the manufactory of each, by any conveyance specified.

As an aid to those who engage upon large clubs, we will count subscriptions by *one* individual for 1869, 1870, and 1871, as *three* subscribers toward a premium. Every *new* subscriber should have the work from the beginning. Bound volumes may be counted in the same way—each as one subscriber—except, of course, when they are obtained as a premium.

Do not fail to note the following Points:

1. All subscribers sent by one person count, though from one or a dozen different post-offices. But

2. State with each name or list of names sent that it is for a premium.

3. Send the names as fast as obtained, that the subscribers may begin to receive the paper at once. You can have any time, from one to six months, to fill up your list.

4. Send the exact money with each list of names, so that there may be no confusion of money accounts.

5. Old and new subscribers all count in premium clubs, but a portion, at least, should be new names; it is partly to get these that we offer premiums to canvassers.

6. Specimen numbers, cards, and show-bills will be supplied free, as needed by canvassers; but they should be used carefully and economically, as they are very costly.

7. Remit money in Checks on New York banks or bankers, payable to order of WESTERN & COMPANY, or send Post-Office Money Orders. If neither of these is obtainable, Register Money Letters, affixing stamps both for the postage and registry; put in the money and seal the letter in the presence of the postmaster, and take his receipt for it. Money sent in any of the above ways is at our risk.

DESCRIPTIVE LIST OF PREMIUMS.

Every Premium in the annexed list is described in the December MANUFACTURER AND BUILDER, *and also in a* **Special Descriptive Sheet,** *which will be sent* **free** *to every one desiring it. We have room here for the following only:*

No. 1—Chest of Good Tools.—We are able, through the special favor of Messrs. Patterson Brothers, of 27 Park Row, to offer chests of the very finest quality of tools, of kinds and prices named below. Similar tools could be purchased for half the money; but these are all A No. 1, for practical use, and worth a dozen common articles. For this we have the guaranof Messrs. Patterson, which is amply sufficient for us, and for all who know them. Any of these tools may be ordered of them. We make up only a single premium, which contains a full assortment for all common purposes. The tools are of regular size, and but few additions would be required for a journeyman carpenter. The assortment we offer is as follows: 1 tool-chest, $8; 1 jack-plane, $1 75; 1 smooth-plane, $1 50; 1 fore-plane, $2 25; 1 handsaw, 22 in., $1 75; 1 compass saw, 10 in., 50c.; compass, 6 in., 37c.; 1 adze-eye hammer, No. 4, $1 25; 1 hatchet, No. 2, 90c.; 1 draw-knife, 7 in., $1 12; 1 try-square, 6 in., 70c.; 1 bevel, 8 in., 75c.; 1 chalk-line and spool, 30c.; 1 mallet, 30c.; 1 pair of pliers, (steel,) 5 in., 60c.; 1 pair of calipers, 4 in., 33c.; 1 brace, No. 2, $2 25; 1 auger-bit, ea., ¼ in., 30c.; ⅜ in., 32c.; ½ in., 45c.; 1 in., 60c.; 1 centre-bit, ea., ½ in., 21c.; ¾ in., 23c.; 1 in., 25c.; 1¼ in., 35c.; 1½ in., 40c.; 6 gimlet-bits, assorted, 90c.; 3 gimlet-bits, assorted, 33c.; 1 screw-driver bit, 25c.; 1 flat countersink, 25c.; rose, do., 25c.; snail, do,, 25c.; 1 octagon reamer, 30c.; 1 taper-bit, 30c.; 1 screw-driver in handle, ea., 3 in., 30c.; 6 in., 50c.; 1 gouge in handle, ea., ½ in., 50c.; 1 in., 70c.; 1 chisel in handle, ea., ¼ in., 30c.; ½ in., 35c.; ¾ in., 40c.; 1 in., 50c.; 1¼ in., 60c.; 1 framing-chisel, ea., ¾ in., $1; 1 in., $1 10; 1¼ in., $1 20; 1 auger, ea., ¾ in., 70c.; 1 in., 80c.; 1¼ in., 90c.; 1 set brad-awls in handles, $1 35; 1 rule, 2 feet, 25c.; 1 saw file, ea., 4 in., 14c.; 5 in., 17c.; 1 flat bastard file, 8 in., 30c.; 1 wood-rasp, 50c.; 1 soldering copper 60c.; solder nails, etc., $1 25 ;=**$45 00.**

Nos. 2, 3—Mathematical Instruments for Draughting, Drawing, Etc.—Very convenient not only for architects and mechanics, but for boys and girls. These are neatly fitted in beautiful rose-wood cases, having dividers with flexible joints, and points, semi-circles, pencil and penholders, rulers, etc., etc. All the pieces in No. 2 are finished in brass and steel; those in No. 3 are German-silver and steel. The pieces are the same in each, but No. 3 is of extra beauty and workmanship. 18 subscribers at $1 50 each secures No. 2, and 22 at $1 50 each, No. 3.

Nos. 4, 5, 6, 7—Pocket Knives.—Here's for th boys and girls. These premiums are among the most pleasing and useful that we have ever offered. Every boy, and girl too, wants a pocket knife. We give them an opportunity to obtain a most valuable one for merely a little effort. These knives are from Messrs. Patterson Bros. No. 4 is a neat, substantial knife, with three blades and buck-horn handle. No. 5 is a still finer article, with four blades and buck-horn handle. No. 6 is an elegant knife, with four blades and shell handle. No. 7 is a lady's pocket-knife, a beautiful article, with four blades and shell handle.

Nos. 8, 9, 10, 11, 12, 13—American Table Cutlery.—We are glad to be able to offer really good articles of American manufacture, such as are competing successfully with the best foreign goods. *Messrs. Patterson Bros., 27 Park Row,* who supply us with these articles, are also importers of English goods. They recommend these knives, manufactured by the *Meriden Cutlery Co.*, as equal to any cutlery in the market, and their recommendation is a guarantee wherever they are known. We offer four kinds knives, and three sizes of each kind. No. 8 have rubber handles, which are actually boiling-water-proof, so that, if they were accidentally to remain in it for several minutes, or even hours, they would not be injured. The blades are of the best steel, and warranted. Dessert size, with forks, sold at $14. For 23 subscribers at $1 50, or 78 at $1, we will give either the medium size or the table size, sold at $15 50. No. 9 have ivory handles, are selected with great care, have steel blades, and are beautiful goods. Dessert size, with forks, sold at $18 50. For 31 subscribers, at $1 50, or 100 at $1, we will send the medium size, sold at $20 50. For 34 at $1 50, or 112 at $1, we will send the table size, sold at $22 50. No. 10 are made of solid steel, and are triple-plated all over with pure silver, which will wear for a long time, while the knife is actually indestructible by ordinary use. Dessert size, with forks, sold at $22. For 37 subscribers, at $1 50, or 118 at $1, we will give the medium size, sold at $24 50. For 38 at $1 50, or 120 at $1, we will send the table size, sold at $25. For 38 at $1 50, or 120 at $1, we will send the table size, sold at $25, No. 11 have steel blades, triple-plated with silver, and larger ivory handles, and are really splendid goods. Dessert size, with forks, sold at $25 50. For 42 subscribers, at $1 50, or 128 at $1, we will give the medium size, sold at $28. For 45 subscribers at $1 50, or 143 at $1, we will give the table size sold at $30 50. The forks, which accompany these premiums, Nos. 8, 9, 10, are made of genuine albata, and warranted double-plated with coin-silver. The forks with No. 11 are warranted triple-plated with coin-silver. These forks are also furnished to us by Messrs. Patterson Bros. The carving-knife and fork, and fluted steel, are made by

the Meriden Cutlery Co., with the best ivory balanced handles.

Nos. 14 to 29—Silverware for the Table.—What would become of elegance and refinement in the furnishing of homes if the ladies (God bless them!) had not such an amiable passion for endlessly beautifying everything around them? Ever since Eve first set out the fruit of Paradise on its broad leaves to entertain the angel guests of Adam, it has been the province of her lovely daughters to spread the social board with attractions still more tempting to the eye than to the palate. What, that becomes a woman, will not a woman do to make her table shine? We condole with them that their means are not always equal to their good taste, and propose that henceforth no lady shall lack a lustrous silver tea-set, or other piece of similar elegance, unless she chooses to. Look at the following premiums, all of the celebrated manufacture of Messrs, HALL, ELTON, & Co., 36 Park Row, New York; No. 28 is silver-plated, gold-lined, beautifully chased **Tea Set** of six pieces, consisting of a coffee-pot, two tea-pots, a creamer, a sugar-bowl, and a slop-bowl. The style of this set is very neat, new and elegant. Messrs. Hall, Elton & Co, warrant these goods to be their best triple plate. This is a very desirable premium. No. 29 is a tea-set with same number of pieces, triple-plated, plain, new style.

Nos. 31, 32, 33, 34, 35—GOLD PENS. Rubber Mounted with Ever-Pointed Pencils—Pens in Gold and Silver Holders—Pens and Pencils in Extension Cases.—No. 31 has a gold-mounted rubber case, with pencil, and a No. 4 gold pen, manufactured by MABIE, TODD & Co., 180 Broadway, New York. This and the next, No. 32, are, we think, really the best things of the kind manufactured. The fact that hard rubber is used, shows that the gold for the mountings, etc., is of the finest quality, as rubber, on account of the sulphur contained in it, can not be mounted with any other without tarnishing. When closed, the pencil No. 31 is only 5 inches long, (No. 32, 3¼ inches,) but it opens to a length of 5¾ inches. The price for the holder and pencil of No. 31 is $6, pen $2; and of No. 32, or smaller size, $5 for the case, and $1 75 for the pen. Fifteen subscribers will give you the former, or gentleman's size, and 13 the latter, or lady's size. No. 33 is a No. 6 gold pen, with silver or gold-plated holder with an ebony handle—a very neat, desirable business-pen. By describing the kind of pen you prefer, we can probably select one that will suit your hand perfectly. We send these by mail, in a neat turkey morocco box, lined with velvet, in which they can be kept, protected from injury. No. 34 is a large pen, in a fine extension case, round or fluted, and richly engraved. The gold is 14 carats fine. These pens, which are nicely put up in boxes, are a very beautiful thing for a present. Price $20, and sent, postage paid, to any address, upon receipt of 29 subscribers at $1 50 each. No. 35 is a lady's gold pen, with ivory holder. Price, $2 75. This is indeed a very neat and beautiful pen for ladies' use. We send it, postpaid, by mail, inclosed in a handsome velvet-lined morocco box, for 6 subscribers.

No. 38—The Celebrated St. Germain or German Student's Lamp.—as it is sometimes called. This lamp is made and furnished to us by C. F. A. HENRICHS. It scarcely needs eulogium, being the standard thing in our leading colleges, both among students and professors. They reject gas, even where it is most plentiful and convenient, and save their much-worked eyes by the motionless pure white light for which this lamp is so remarkable. No other artificial illumination approaches so nearly to the still colorless sunlight. The secret is in the scientific adaptation of burner and chimney to produce that perfection of draught by which absolute combustion is attained without vibration. The porcelain shade softens the light most agreeably. The lamp slides on a vertical standard, and is adjusted by a set-screw at any desirable elevation to accommodate the work or the eyes. The reservoir is elevated above and at a short distance from the burner, (communicating by a pipe,) so that the oil is always cool and out of reach of flame. The reservoir can be taken out of its telescopic socket, and carried away to another room and filled and returned, without putting out the light. The lamp will be a treasure worth no little trouble to obtain to any one who needs strong light, or who values eye-sight, economy, neatness, pure air, and freedom from trouble and annoyance with lamps; as in all these points it is without a peer. The price of these lamps is $8, with 25 cents for packing. The mineral sperm oil can be had from most respectable dealers, or ordered in packages of any size (1 gallon upward) from Messrs. HENRY RUSSELL & Co., 38 Park Place, New-York.

No. 39—Family Scales.—These scales combining the advantages of counter and platform scales, are peculiarly adapted to household purposes. They weigh from ½ ounce to 240 lbs. They have a scoop or pan for weighing flour, sugar, and other house stores, and a platform for heavier articles, and are just such an apparatus as is needed for in-door or out-door use, occupying less than two feet square. These scales are manufactured by the well-known FAIRBANKS & Co., No. 252 Broadway New York, whose weighing apparatus has long ranked as the standard in all parts of the country. Send to them for circulars, if desired.

Nos. 45-53—Bailey's Patent Planes.—To those who have used these planes and know their value, it is but small praise to say that they are superior to any others made. They are so far ahead of any others that there can be no comparison between them. They are self-adjusting in every respect. Both the wood and iron planes are entirely independent in themselves, requiring neither hammer, screw-driver, nor wrench to replace or adjust the cutter, which is held firmly in place and can be instantly released by use of the cam and its thumb-piece. The cutter is adjusted by simply turning a thumb-screw under the bed-piece upon which the plane-iron rests. By this the cutter can be adjusted to any thickness of shaving. The Stanley Rule and Level Co., 55 Chambers Street, New York, warrant these planes to be of the best stock and finish. The various numbers and sizes of these planes which we offer gives carpenters, mechanics, and others desiring them, an opportunity to get a complete set of either the wood or iron planes as premiums. The smooth planes, of which we offer two sizes, are 5½ inches long, 1¾ inch cutter; and 8 inches long, 1¾ inch cutter.

Jack plane..	....14 in. long,	2	in. cutter.	
Fore "	.....18 " "	2¼	" "	Iron.
Jointer "	.....22 " "	2¾	" "	

In the wood planes the lengths and widths of cutter embrace all sizes made. Forty-four subscribers at $..50 each, or 141 subscribers at $1 each, will get a complete set of the wood-planes. Sixty-nine subscribers at $1.50 will get a complete set of the iron planes, which will last a life-time. If larger sizes than those given are wanted, a few extra subscriptions will be required, according to the difference in the price.

Nos. 54-76—Machinists' Tools.—This series of premiums, consisting of machinists' tools, etc., has been selected and put up at the suggestion of several practical men with whom we have consulted in regard to the subject. These gentlemen, who have a practical knowledge of the tools, and of the requirements of all who have any thing to do with the working of metals, give their unqualified approval of the tools we have selected. This list of premiums has been made so extensive that every man who has any industrial operrtions to carry on will find some tool or tools absolutely necessary to him. By sending us clubs of subscribers to THE MANUFACTURER AND BUILDER these tools may be obtained by the smallest possible amount of labor. Of the qualities of these tools, in point of finish, we know them to be the best in the market—the best, without challenge. When a man has a set of any of them in his tool-chest, he knows he has the means of producing work equal to any that can be done. We obtain these tools from the general agents, Messrs. POST & GODDARD, 109 Liberty Street, New York.

No. 77—Foot-Lathe No. 1.—Of these useful articles we offer two kinds. No. 1 is perfectly adapted for most kinds of turning in wood or metals; also drilling, boring, polishing, sawing, etc. It seems to be the size desired by most people. This is proved by the great numbers of them sold. This lathe takes a piece between centres 19 inches long and 6¼ inches wide in diameter. It weighs 200 pounds. It is fitted with two pointed centres, one spur-centre, face-plate turned and polished, twe rests, one 9 and the other three inches long; also centre key and wrench combined, which fits the screw heads in different parts of the lathe. The balance-wheel weighs 45 pounds, is turned true, and is polished. It has two sizes for change of speed. This size of lathe has a great many extra parts made for it, so that whenever they are wanted they can be obtained. This is a very valuable point, as in buying other machines of the kinds only such things as happen to fit can be used, and they are not always to be found when wanted. The Rev. JOHN TODD, D.D., speaking of lathes, says in regard to these, "For price, for finish, for beauty and workmansip, I have never seen any American lathe so desirable. Of the No. 1 he says: "Nobody can own the lathe without daily gratitude." We procure these lathes through Mr. LUCIUS W. POND, 98 Liberty street, the well-known manufacturer of machinists' tools. Few people can obtain one of these lathes more easily than by obtaining 65 subscribers for THE MANUFACTURER AND BUILDER, for which we ship this premium, without any additional charge for boxing. The regular price is $50. We include leather belt 8 feet long, which costs 90 cents in the price given in the table.

No. 78—Foot Lathe, No. 2.—Our subscribers are frequently asking for second-hand lathes, saying at the same time that such a one would answer their purpose, and probably come cheaper. There are many others who do not care for so complete a lathe as No. 1. The No. 2, we think, will answer this demand. It is made of cheaper materials, but in the same style as lathe No. 1. The frame is of wood, with curved legs, which give it a neat and attractive appearance. It is painted and ornamented in the best style. The bed is made with iron slides three feet long. Will take a piece between centres 21 inchhes long and 6¼ inches in diameter. It has an iron pulley like No. 1. The spindle runs accurately. The face-plate takes off, and the centres are fitted to tapering sockets. Tailstock spindle traverses with a left-hand screw. Everything is well fitted and finished. The balance-wheel is the same pattern as for lathe No. 1, and is turned true. The lathe, with face-plate, long and short T rests, two pointed centres, spur-centre, and wrench, packed for transportation, costs $30. For this we also include the leather belt, 8 feet long, which is used on the driving wheel. We box this lathe and deliver it on the cars for a club of 47 subscribers at $1 50 each, or 124 at $1. The twist-drills and chucks—premiums 65, 66, and 69 to 73—especially the smaller sizes, are just the things for these lathes. The chucks, No. Ox, 2 and 3, cost $2 extra for fitting in the lathe. Those desiring further information in regard to the premium may send to WESTERN & Co., 37 Park Row, New York, for an illustrated pamphlet.

No. 79—The Dollar Steam-Engine.—This is a real working steam-engine and boiler, which runs half an hour, or until its fill of water is evaporated, by means of a small spirit-lamp, which forms a part of it. It can not explode or get out of order. A most instructive as well as entertaining toy. Sent, prepaid, for 5 subscriders at $1 50. It is manufactured by COLBY BROTHERS & Co.

Nos. 80, 81, 82, 83—Compact and Powerful Portable Steam-Engine and Boiler.—BAXTER'S patent is acknowledged by many experienced engineers to be the most perfect combination, of standard principles exclusively, and thorough workmanship, ever made in a portable engine. At the same time such is its compactness and the scale and system on which it is manufactured, (by the Colt Armory, at Hartford, Ct.,) that it is afforded at the lowest price ever known for the same (actual) power. It is made by machine tools constructed expressly for it, of standard interchangeable parts throughout, like the celebrated American watches. Consequently we are able to make it one of our most attractive and valuable premiums. Besides, it is warranted to consume less fuel per horse-power than any other engine. This is in consequence, partly, of the improved arrangement of the boiler and the cylinder being entirely let into the steam-space, to save room and heat. The one-horse engine and boiler (which, like the others, will run above, not below rated power) stands but five feet high, over all, by two feet in diameter. This is premium No. 80, costs $300, and can be had for 320 subscribers at $1 50 each, or 1125 at $1 each. The five-horse engine and boiler stands 6¼ feet high by 3 feet in diameter, costs $800, and can be had for 858 subscribers at $1 50 each. The ten-horse engine costs $1200, and will run a good sized manufactory. There is now no reason why any body should be without a first-class steam-engine, especially as these engines are so simple, snug, safe, and economical of fuel that they can be run in any apartment by the fire required to warm it, and by and person of common intelligence, and will be received from the factory in perfect readiness for use. For running small lathes, drills, etc., circular and scroll saws, printing-presses, corn-huskers, cider-mills, fanning-mills, feed-mills, cotton-gins and hullers, cheese-presses, churns, pumps, washing-machines, sewing-machines, rotary blowers for forges and other purposes, etc., the smallest of these engines will be found thoroughly effective, and as little incnmbrance and trouble as a kitchen stove. For business, however, we recommend to try for one of ample rather than of bare sufficiency.

Nos. 84, 85, and 86—Steam-Pumps.—These steam-pumps are of the best class and quality, economical in the use of steam, and capable of being applied in various ways. No. 84 is one of Hardick's manufacture, which took the first prize at the Fair of the American Institute a year ago. Nos. 85 and 86 are two sizes of the celebrated Cameron pump. Nos. 1 and 2. The first has a steam cylinder 4½ by 7 inches, and its capacity of ordinary speed is 15 gallons per minute, and costs $150. Size No. 2 has a steam cylinder 6 inches in diameter, with 8-inch stroke. It costs $200, and is capable at ordinary speed of delivering 30 gallons of water per minute. These pumps are remarkable for their compactness, simplicity, and durability. The valves are large and not liable to become choked up. By simply removing the bonnet, access can be had to them for inspection or repair,

Nos. 105 to 108—To Procure a Patent without Money.—We have met with many having valuable inventions, which inventors are anxious to get patented, but are unable to afford the expense, and consequently fail to secure the profits which a patent might produce. To such as are in this position, we make the following liberal offer: No. 108—We will prepare an application for a patent, attend to its passage through the Patent Office, and pay all government fees and incidental expenses attending the same, for any inventor presenting a patentable invention, who will get up a club of seventy-five subscribers for THE MANUFACTURER AND BUILDER for one year at $1,50 each, or 250 at $1 each, and send us the money by post-office order. If this application should be rejected, they may send us an additional list of thirty subscribers at $1.50 each, and the subscription money for the same, on receipt of which we will prepare and prosecute a second application, paying all government fees and incidental expenses. No. 107—For a list of fifty subscribers at $1.50 each, or 150 at $1 each, with the cash accompanying it, we will prepare an application, attend to its passage through the office, and pay the government fee ($15), the applicant paying the second government fee of $20. No. 106—For a list of thirty-five subscribers at $1.50, sent in the same way, we will prepare and prosecute an application, the applicant paying the government fee. No. 105—for twenty-eight subscribers at $1.50 each, or eighty at $1 each, we will prepare and file a caveat, furnish the necessary drawings, (which we also furnish in all the above cases), and pay all government fees. All cases placed in our hands under these arrangements will receive our best attention, equally with those for which our fees have been paid in cash, and will be appealed to the Board of Examiners-in-Chief if necessary, the applicant paying the government fee of $10 on such appeal. If the inventor has no model to accompany his application, he may procure additional subscribers, the premium on which (see cash rates) will enable him to pay for the model. A club of 100 names has been obtained in a single establishment where from 150 to 200 hands are employed. A village of 500 inhabitants will take this number readily.

No. 129—Sewing Machines.—Your choice! A $65 machine for 65 subscribers, at $1.50 each.—It makes no difference to us which machine we send, or whether it is selected at first or at the last moment. No charge for boxing the machines; they go safely as freight. For circulars, giving full particulars in regard to style of machines, fixtures, etc., as well as instructions, send to **Grover & Baker Manufacturing Co., 495** Broadway, New York; **Florence Sewing Machine Co., 505** Broadway, New York; **Wilcox & Gibbs Sewing Machine Co., 658** Broadway, New York; **Singer Sewing Machine Co., 458** Broadway, New York.

Nos. 137, 138—Volumes of the Manufacturer and Builder.—The unbound volumes of THE MANUFACTURER AND BUILDER consist of a set of numbers for a year, each separate in its own paper cover. These volumes amount to a valuable Library on all matters pertaining to the Industrial Arts, and contain more varied information on manufacturing, building, and mechanical subjects than can be obtained in books costing three times as much. The price of the volumes unbound is $1.50 each, at the office, or $1.75 if sent by mail, as they must be post-paid. They are profusely illustrated, the engravings used in them having alone cost thousands of dollars. For ordinary use, the sets of numbers unbound will answer quite well.

Nos. 139, 140—Bound Volumes of the Manufacturer and Builder.—*New* subscribers almost invariably desire to secure the back numbers of THE MANUFACTURER AND BUILDER from its commencement. Some desire them bound in our uniform style, while others prefer to get the loose numbers and have them bound to suit their own tastes. *Our* binding is very neat, and being done in large quantities at one time, is furnished at a *very cheap* rate. It is moreover very handsome, being of cloth, with gilt title and back, sides embossed and ornamented with a neat architectural device stamped in gold. The price of the volumes is $2.50 each, sent post-paid.

No. 141—Covers for Binding the Manufacturer and Builder.—These are described in premium 139, 140. Now ready for 1869 and 1870. Be careful to state *which year* you require. Any country binder will insert the year's numbers in one of these covers at a moderate cost. Price, 50 cents; sent, *post-paid*, on receipt of three subscribers at $1,50 for each cover.

Nos. 142 to 154—Good Libraries.—In these premiums we offer a choice of books for manufacturers, mechanics, artisans, builders and others. The person entitled to any one of the premiums 142 to 153, may select any books desired from the list published in our Special Premium Sheet, to the amount of the premiums, and the books will be forwarded, post or express paid. $25 or $50 worth of books pertaining to the industrial arts will give the boys new ideas, set them to thinking and observing, and thus enable them to make their heads help their hands. Any good book will, in the end, be of far more value to a youth than to have an extra hundred dollars on coming to manhood. ☞ Let the mechanics of a neighborhood unite their efforts, and through these premiums get an industrial library for general use.

No. 154—General Book Premium.—Any one sending twenty-five or more names may select books from our list to the amount of ten cents for each subscriber sent at $1; or thirty cents for each name sent at $1.20; or sixty cents for each name at $1.50. *This offer is only for clubs of twenty-five or more. The books will be sent by mail or express, prepaid through by us.*

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" " " 20 "	10 00	
" " " 30 "	16 50	$1 50
" " " 40 "	24 00	4 00
" " " 50 "	32 50	7 50
" " " 75 "	48 75	11 25
" " " 100 "	65 00	15 00
" " " 200 "	140 00	40 00
" " " 500 "	350 00	100 00
" " " 1000 "	700 00	200 00

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"	"	15	"	"	20..	1 10	"	"
"	"	20	"	"	30..	1 00	"	"
"	"	30	"	"	40..	95	"	"
"	"	40	"	"	50..	90	"	"
"	"	50	"	"	200..	85	"	"
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The Profits of the Cash Business, it will be seen by the above tables, are large and accrue rapidly. Every experienced canvasser knows that it is far easier to obtain 4 subscribers to a paper like THE MANUFACTURER AND BUILDER at $1 50 each than to get 1 subscriber to a high-priced magazine, costing $6. This is more strikingly evident when the fact is taken into consideration that our paper, costing only $1 50, is ACTUALLY SUPERIOR IN EVERY RESPECT TO ANY THING OF THE KIND IN THE COUNTRY COSTING TWICE THAT SUM.

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—o—

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As will be seen by examining the List.

In these days, CAPITAL is necessary for establishing the enormous circulation required to make a first-class periodical like THE MANUFACTURER AND BUILDER profitable in spite of its gigantic expenses. Capital is necessary to pay for the best productions of the best writers, for the costly designs and engravings, for the fine, thick paper, and for the extra style of printing, that make THE MANUFACTURER AND BUILDER the type of a new era in American polytechnic journalism. Capital is above all necessary to PAY THE ARMY OF CANVASSERS employed in bringing the merits and benefits of this journal home to the intelligent millions of the American people.

OUR PLAN FOR

1871

IS

CAPITAL WITHOUT STINT

For these purposes, and

MAGNIFICENT PAY

To all who help us.

We desire to pay out the coming year not less than a Quarter of a Million of Dollars from our receipts and reserves, for the services of Volunteer Agents alone, in all the States, Territories, and Provinces of North America. Our paper challenges comparison with the best Journals of Arts and Engineering in the world. It is at the same time one of the cheapest publications ever issued from the press; and to all its attractions we now add a range of Premiums tantamount almost to a free gift of our paper, our labor, our earnings, for the year, for the sake of introducing THE MANUFACTURER AND BUILDER to myriads of readers, whose patronage in future years will recompense our present lavish outlay.

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In the following table is given the price of each article and the number of subscribers required to get it free, at $1 50 a year; also at the club rate of $1 a year. The descriptions of a few articles are given in the fourth column, the balance is given in our *Descriptive Premium Sheet*, which will be sent on application to those who contemplate getting up clubs.

List of Premiums and Terms for Vol. III., 1871.

A Free Field for Everybody. No Competition.

No.	Names of Premium Articles.	Price of Premium.	Number of Subscribers required at $1 50	at $1
	FROM PATTERSON & BROS.			
1	Tool-Chest	$45 00	60	190
2	Case Mathematical Instruments	9 00	18	55
3	Case Mathematical Instruments	15 00	22	75
4	Pocket Knife	1 50	4	21
5	Pocket Knife	2 00	5	22
6	Pocket Knife	2 50	6	25
7	Lady's Pocket Knife	2 00	5	22
8	One dozen Knives and Forks	14 00	21	70
9	One dozen Knives and Forks	18 50	27	90
10	One dozen Knives and Forks	22 00	33	110
11	One dozen Knives and Forks	25 50	39	124
12	Carver and Fork	5 00	13	37
13	Fluted Sharpening Steel	2 50	6	25
	FROM HALL, ELTON & CO.'S PLATE.			
14	One dozen Tea-spoons, medallion	5 75	14	40
15	One dozen Table-spoons, medallion	12 00	19	65
16	One dozen Table Forks, medallion	12 00	19	65
17	Butter-Knife, medallion, solid	1 00	4	
18	Soup-Ladle, medallion	5 75	14	40
19	Ice or Water-Pitcher, No. 3	17 00	26	80
20	Pocket Fruit-Knife, No. 12	2 00	5	22
21	Revolving Butter-Cooler, No. 80.	8 00	16	52
22	Cake-Basket, No. 1867	10 00	18	58
23	Caster, 6 bottles, chased, No. 2039	9 25	18	54
24	Fruit-Basket, No. 200	13 50	21	75
25	Child's Cup, No. 041	2 75	6	25
26	Knife, Fork, and Spoon, child's set, morocco case	3 00	8	30
27	One dozen Napkin-Rings, medallion	9 00	17	54
28	Tea Set, gold lined, No. 1822	48 00	52	180
29	Tea Set, No. 1866	36 00	45	135
	FROM COLBY BROS. & CO.			
30	Knife-Cleaner	75	2	
	FROM MAHE, TODD & CO.			
31	Gold Pen and Pencil, rubber case	8 00	15	45
32	Gold Pen and Pencil, rubber case	6 75	13	37
33	Gold Pen, silver or gold holder, in box	4 25	9	32
34	Gold Pen, extension gold case, in box	20 00	29	90
35	Lady's Gold Pen, ivory holder, in box	2 75	6	25
	FROM HENRY RUSSELL & CO.			
36	Downer Mineral Oil Lamp, No. 1956	4 75	10	35
37	Downer Mineral Oil Lamp, No. 1955	9 25	17	56
	FROM C. F. A. HEINRICH.			
38	St. Germain Student Lamp, largest size	8 25	15	45
	FROM FAIRBANKS & CO.			
39	Family Scales	14 00	21	70
	FROM COLBY BROS. & CO.			
40	Clothes-Wringer	7 50	10	35
	FROM ALEXANDER M. LESLEY.			
41	Refrigerator, the Zero, No. 38	38 00	42	142
42	Cooler, the Newport, No. 1	12 00	15	45
43	Hot-Air Coal Furnace, the Gothic, No. 9	125 00	135	450
44	Hot-Air Wood Furnace, Gothic, No. 10	150 00	162	525
	FROM THE STANLEY RULE & LEVEL CO.			
45	Iron Smoothing-Plane, Bailey's patent	5 00	13	37
46	Iron Smoothing-Plane, Bailey's patent	6 50	14	42
47	Iron Jack-Plane, Bailey's patent	7 50	15	47
48	Iron Fore-Plane, Bailey's patent	9 00	17	55
49	Iron Jointer-Plane, Bailey's patent	10 00	18	58
50	Wood Smoothing-Plane, Bailey's patent	3 00	8	30
51	Wood Fore-plane, Bailey's patent	4 50	10	35
52	Wood Jointer-Plane, Bailey's patent	4 75	12	36
53	Wood Jointer-Plane, Bailey's patent	5 50	14	40
	FROM POST & GODDARD.			
54	Machinists' Hand-Taps	17 60	25	75
55	Machinists' Hand-Taps	52 80	65	220
56	Machinists' Hand-Taps (your choice)			
57	Screw-Plates and Dies, size A	5 00	12	37
58	Screw-Plates and Dies, size B 1	8 00	15	45
59	Screw-Plates and Dies, size C 1	10 00	18	58
60	Screw-Plates and Dies, size D 1	13 00	20	70
61	Tap-Wrenches, size A	3 00	7	25
62	Tap-Wrenches, size B	4 00	9	30
63	Tap-Wrenches, size C	5 00	12	37
64	Set of 11 Taper Shank-Twist Drills, No. 1	19 75	29	90
65	Set of 29 Drills, straight shank, mounted, No. 9	12 00	18	60
66	Set of 60 Drills, steel wire gauge from 1 to 60, No. 12	8 00	15	45
67	Set of 21 Taper-Shank Drills, No. 3	44 00	58	175
68	Set of 9 Bit-Stock Drills, 1-16 to ¾ in.	2 80	6	25
69	Self-Centering Drill-Chucks, Beach's patent, for jewelers, No. 0	10 00	18	58
70	Self-Centering Drill-Chucks, Beach's patent, for drilling, No. 0	7 00	14	40
71	Self-Centering Drill-Chucks, Beach's patent, 0 to 3-16, No. 1	6 00	13	38
72	Self-Centering Drill-Chucks, Beach's patent, 1 to 60 S. W. E., No. IX	7 00	14	40
73	Self-Centering Drill-Chucks, Beach's patent, 0 to ½, No. 3.	14 00	23	77
74	Drill-Grinding Machine, No. 1	10 00	18	58
75	Drill-Grinding Machine, No. 2	20 00	30	95
76	Auger-Bits, your choice of 4 sets	— —	—	—
	FROM L. W. POND.			
77	Foot-Lathe, No. 1	50 00	65	204
78	Foot-Lathe, No. 2	30 90	47	124
	FROM COLBY BROS. & CO.			
79	Miniature Steam-Engine and Boiler	1 36	5	23
	FROM RUSSELL & ERIE.			
80	Steam-Engine (1 H. P.) and Boiler	300 00	310	1125
81	Steam-Engine (3 H. P.) and Boiler	600 00	640	3250
82	Steam-Engine (5 H. P.) and Boiler	800 00	858	3000
83	Steam-Engine (10 H. P.) and Boiler	1200 00	1285	4500
84	Steam-Pump, C. B. Hardick's, No. 0	120 00	155	540
85	Steam-Pump, Cameron & Co.'s, No. 1	150 00	192	675
86	Steam-Pump, Cameron & Co.'s, No. 2	200 00	257	900
87	American Submerged Pump	12 00	19	65
	FROM GEORGE TALLCOT.			
88	Turbine Water-Wheel, Reynold's, 12 in.	105 00	125	360
89	Turbine Water-Wheel, Reynold's, 24 in.	226 50	270	800
90	Turbine Water-Wheel, Reynold's, 36 in.	384 50	460	1850
91	Rotary Blower, Root's patent, No. 1	$50 00	70	275
92	Rotary Blower, Root's patent, No. 2	80 00	105	420
93	Portable Forge, Root's patent, No. 1	48 00	65	260
94	Portable Forge, Root's patent, No. 3	80 00	105	420
	FROM THE AMERICAN SAW CO.			
95	Circular Saw	125 00	135	473
96	Cross-Cut Saw	6 60	14	42
	FROM A. P. & M. STEPHENS.			
97	Labor-Saving Vise, 2-in. jaw	4 00	9	32
98	Labor-Saving Vise, 4½-in. jaw	12 00	28	58
	FROM THE STANLEY RULE & LEVEL CO.			
99	Boxwood two-foot Rule	2 50	6	25
100	Silver-Plated Triangular Drawing-Scale	6 00	16	52
101	Pocket Sheet-Metal Gauge	5 00	13	37
102	Arkansas Oil-Stone	1 75	5	22
103	Arkansas Oil-Stone, mahogany case	3 25	8	30
104	Gear or Cog-Wheel Calculating-Rule	4 00	12	36
	WESTERN & COMPANY'S AGENCY.			
105	Preparing and Filing a Caveat	25 00	28	80
106	Application for a Patent	30to40	35	100
107	Application for Patent and first Government fee	46to56	50	150
108	Application for Patent and all Government fees	66to76	75	250
	FROM J. W. HUTCHINSON.			
109	English Breech-loading double-barrel Gun	100 00	110	350
110	English Muzzle-loading double-barrel Gun	75 00	85	250
111	Breech-loading Rifle, the Allen	30 00	46	150
112	Revolver, Smith & Wesson's, No. 1½	12 50	19	65
113	Revolver, Smith & Wesson's, No. 2	15 00	22	75
	FROM MASON & HAMLIN.			
114	Melodeon, portable, No. 1, 4 octave	50 00	66	200
115	Melodeon, resonant, style G, 5 octave	170 00	146	510
116	Pipe-Organ, church use, style No. 29	675 00	579	2000
	FROM J. S. & C. ODELL.			
117	Pipe-Organ	500 00	430	1500
118	Pipe-Organ	700 00	600	2100
119	Bradbury Square Piano-Forte, No. 4	650 00	430	1500
120	Steinway's No. 1 Grand Piano	1200 00	860	3000
	THE AMERICAN WATCH CO., WALTHAM, MASS.			
121	Silver Watch	20 00	32	100
122	Silver Watch	35 50	48	142
123	Gold Watch	50 00	65	200
124	Lady's Gold Watch	100 00	110	350
	FROM THE UNITED STATES WATCH CO.			
125	Silver Watch	40 00	50	150
126	Silver Watch	66 00	75	275
127	Gold Watch	100 00	100	300
128	Silver Watch	104 00	104	312
129	A Sewing Machine (your choice)	65 00	65	200
	FROM MCALLISTER.			
130	Microscope and 48 objects	10 00	14	40
	FROM COLBY BROS. & CO.			
131	Velocipede for Boys	16 00	16	52
	FROM MCALLISTER.			
132	Magic-Lantern, No. 433	20 00	30	95
	FROM H. THOMPSON.			
133	An Easy Chair			
	FROM D. APPLETON & CO.			
134	New American Cyclopædia, 16 vols.	80 00	80	213
	FROM G. & C. MERRIAM.			
135	Webster's Unabridged Pictorial Dictionary	12 00	15	45
136	Webster's National Pictorial Dictionary	6 00	10	35
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137	One back vol. Manufacturer and Builder, unbound, postpaid	1 75	6	25
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139	One back vol. Manufacturer and Builder, bound, postpaid	2 50	9	32
140	Two back volumes Manufacturer and Builder, bound, postpaid	5 00	18	58
141	Cover for binding the Manufacturer and Builder, postpaid	60	3	21
142	A $10 Library (your choice from list in special sheet),	10 00	18	58
143	A $15 Library,	15 00	24	85
144	A $20 Library,	20 00	31	106
145	A $25 Library,	25 00	38	125
146	A $30 Library,	30 00	44	144
147	A $35 Library,	35 00	50	162
148	A $40 Library,	40 00	56	177
149	A $45 Library,	45 00	62	192
150	A $50 Library,	50 00	68	207
151	A $60 Library,	60 00	80	237
152	A $75 Library,	75 00	100	282
153	A $100 Library,	100 00	125	360
154	A choice of good Books (see terms in another column)			
155	A choice of convenient Book-Cases (see special sheet)			
156	A choice of popular Music (see terms in special sheet)			
157	A choice of Games and Toys, (see terms in special sheet)			

All paid through by mail or express.

We have taken especial pains to select in making up our price list the NEWEST and very BEST articles. No charge will be made for boxing or packing any article on our list. The Premiums, Nos. **4** to **7** inclusive, **31** to **35** inclusive, **79**, **99**, **101**, **105** to **108** inclusive, **121** to **128** inclusive, **137** to **141** inclusive, **154**, **156**, **157**, will each be delivered FREE of charge by mail or express (at the Post-office or express office nearest recipient) to any place in the United States or Territories. The other articles cost the recipient only the freight after leaving the manufactory of each, by any conveyance specified.

As an aid to those who engage upon large clubs, we will count subscriptions by *one* individual for 1869, 1870, and 1871, as *three* subscribers toward a premium. Every *new* subscriber should have the work from the beginning. Bound volumes may be counted in the same way—each as one subscriber—except, of course, when they are obtained as a premium.

Do not fail to note the following Points:

1. All subscribers sent by one person count, though from one or a dozen different post-offices. But

2. State with each name or list of names sent that it is for a premium.

3. Send the names as fast as obtained, that the subscribers may begin to receive the paper at once. You can have any time, from one to six months, to fill up your list.

4. Send the exact money with each list of names, so that there may be no confusion of money accounts.

5. Old and new subscribers all count in premium clubs, but a portion, at least, should be new names; it is partly to get these that we offer premiums to canvassers.

6. Specimen numbers, cards, and show-bills will be supplied free, as needed by canvassers; but they should be used carefully and economically, as they are very costly.

7. Remit money in Checks on New York banks or bankers, payable to order of WESTERN & COMPANY, or send Post-Office Money Orders. If neither of these is obtainable, Register Money Letters, affixing stamps both for the postage and registry; put in the money and seal the letter in the presence of the postmaster, and take his receipt for it. Money sent in any of the above ways is at our risk.

DESCRIPTIVE LIST OF PREMIUMS.

Every Premium in the annexed list is described in the December MANUFACTURER AND BUILDER, *and also in a* **Special Descriptive Sheet,** *which will be sent* **free** *to every one desiring it. We have room here for the following only:*

No. 1—Chest of Good Tools.—We are able, through the special favor of Messrs. Patterson Brothers, of 27 Park Row, to offer chests of the very finest quality of tools, of kinds and prices named below. Similar tools could be purchased for half the money; but these are all A No. 1, for practical use, and worth a dozen common articles. For this we have the guaranof Messrs. Patterson, which is amply sufficient for us, and for all who know them. Any of these tools may be ordered of them. We make up only a single premium, which contains a full assortment for all common purposes. The tools are of regular size, and but few additions would be required for a journeyman carpenter. The assortment we offer is as follows: 1 tool-chest, $8; 1 jack-plane, $1 75; 1 smooth-plane, $1 50; 1 fore-plane, $2 25; 1 handsaw, 22 in., $1 75; 1 compass saw, 10 in., 50c.; compass, 6 in., 37c.; 1 adze-eye hammer, No. 4, $1 25; 1 hatchet, No. 2, 90c.; 1 draw-knife, 7 in., $1 12; 1 try-square, 6 in., 70c.; 1 bevel, 8 in., 75c.; 1 chalk-line and spool, 30c.; 1 mallet, 30c.; 1 pair of pliers, (steel,) 5 in., 60c.; 1 pair of calipers, 4 in., 33c.; 1 brace, No. 2, $2 25; 1 auger-bit, ea., ¼ in., 30c.; ½ in., 32c.; ¾ in., 45c.; 1 in., 60c.; 1 centre-bit, ea., ¼ in., 21c.; ½ in., 23c.; 1 in., 25c.; 1¼ in., 35c.; 1½ in., 40c.; 6 gimlet-bits, assorted, 90c.; 3 gimlet-bits, assorted, 33c.; 1 screw-driver bit, 25c.; 1 flat countersink, 25c.; rose, do., 25c.; snail, do,, 25c.; 1 octagon reamer, 30c.; 1 taper-bit, 30c.; 1 screw-driver in handle, ea., 3 in., 30c.; 6 in., 50c.; 1 gouge in handle, ea., ½ in., 50c.; 1 in., 70c.; 1 chisel in handle, ea., ¼ in., 30c.; ½ in., 35c.; ¾ in., 40c.; 1 in., 50c.; 1¼ in., 60c.; 1 framing-chisel, ea., ¾ in., $1; 1 in., $1 10; 1¼ in., $1 20; 1 auger, ea., ¾ in., 70c.; 1 in., 80c.; 1¼ in., 90c.; 1 set bradawls in handles, $1 35; 1 rule, 2 feet, 25c.; 1 saw file, ea., 4 in., 14c.; 5 in., 17c.; 1 flat bastard file, 8 in., 30c.; 1 wood-rasp, 50c.; 1 soldering copper, 60c.; solder nails, etc., $1 25;=**$45 00.**

Nos. 2, 3—Mathematical Instruments for Draughting, Drawing, Etc.—Very convenient not only for architects and mechanics, but for boys and girls. These are neatly fitted in beautiful rosewood cases, having dividers with flexible joints, and points, semi-circles, pencil and penholders, rulers, etc., etc. All the pieces in No. 2 are finished in brass and steel; those in No. 3 are German-silver and steel. The pieces are the same in each, but No. 3 is of extra beauty and workmanship. 18 subscribers at $1 50 each secures No. 2, and 22 at $1 50 each, No. 3.

Nos. 4, 5, 6, 7—Pocket Knives.—Here's for th boys and girls. These premiums are among the most pleasing and useful that we have ever offered. Every boy, and girl too, wants a pocket knife. We give them an opportunity to obtain a most valuable one for merely a little effort. These knives are from Messrs. Patterson Bros. No. 4 is a neat, substantial knife, with three blades snd buck-horn handle. No. 5 is a still finer article, with four blades and buck-horn handle. No. 6 is an elegant knife, with four blades and shell handle. No. 7 is a lady's pocket-knife, a beautiful article, with four blades and shell handle.

Nos. 8, 9, 10, 11, 12, 13—American Table Cutlery.—We are glad to be able to offer really good articles of American manufacture, such as are competing successfully with the best foreign goods. *Messrs. Patterson Bros., 27 Perk Row,* who supply us with these articles, are also importers of English goods. They recommend these knives, manufactured by the *Meriden Cutlery Co.*, as equal to any cutlery in the market, and their recommendation is a guarantee wherever they are known. We offer four kinds knives, and three sizes of each kind. No. 8 have rubber handles, which are actually boiling-water-proof, so that, if they were accidentally to remain in it for several minutes, or even hours, they would not be injured. The blades are of the best steel, and warranted. Dessert size, with forks, sold at $14. For 23 subscribers at $1 50, or 78 at $1, we will give either the medium size or the table size, sold at $15 50. No. 9 have ivory handles, are selected with great care, have steel blades, and are beautiful goods. Dessert size, with forks, sold at $18 50. For 31 subscribers, at $1 50, or 100 at $1, we will send the medium size, sold at $20 50. For 34 at $1 50, or 112 at $1, we will send the table size, sold at $22 50. No. 10 are made of solid steel, and are triple plated all over with pure silver, which will wear for a long time, while the knife is actually indestructible by ordinary use. Dessert size, with forks, sold at $22. For 37 subscribers, at $1 50, or 118 at $1, we will give the medium size, sold at $24 50. For 38 at $1 50, or 120 at $1, we will send the table size, sold at $25. For 38 at $1 50, or 120 at $1, we will send the table size, sold at $25, No. 11 have steel blades, triple-plated with silver, and larger ivory handles, and are really splendid goods. Dessert size, with forks, sold at $25 50. For 42 subscribers, at $1 50, or 128 at $1, we will give the medium size, sold at $28. For 45 subscribers at $1 50, or 143 at $1, we will give the table size sold at $30 50. The forks, which accompany these premiums, Nos. 8, 9, 10, are made of genuine albata, and warranted double-plated with coin-silver. The forks with No. 11 are warranted triple-plated with coin-silver. These forks are also furnished to us by Messrs. Patterson Bros. The carving-knife and fork, and fluted steel, are made by

the Meriden Cutlery Co., with the best ivory balanced handles.

Nos. 14 to 29—Silverware for the Table.—What would become of elegance and refinement in the furnishing of homes if the ladies (God bless them!) had not such an amiable passion for endlessly beautifying everything around them? Ever since Eve first set out the fruit of Paradise on its broad leaves to entertain the angel guests of Adam, it has been the province of her lovely daughters to spread the social board with attractions still more tempting to the eye than to the palate. What, that becomes a woman, will not a woman do to make her table shine? We condole with them that their means are not always equal to their good taste, and propose that henceforth no lady shall lack a lustrous silver tea-set, or other piece of similar elegance, unless she chooses to. Look at the following premiums, all of the celebrated manufacture of Messrs, HALL, ELTON, & Co., 36 Park Row, New York; No. 28 is silver-plated, gold-lined, beautifully chased **Tea Set** of six pieces, consisting of a coffee-pot, two tea-pots, a creamer, a sugar-bowl, and a slop-bowl. The style of this set is very neat, new and elegant. Messrs. Hall, Elton & Co, warrant these goods to be their best triple plate. This is a very desirable premium. No. 29 is a tea-set with same number of pieces, triple-plated, plain, new style.

Nos. 31, 32, 33, 34, 35—GOLD PENS, Rubber Mounted with Ever-Pointed Pencils—Pens in Gold and Silver Holders—Pens and Pencils in Extension Cases.—No. 31 has a gold-mounted rubber case, with pencil, and a No. 4 gold pen, manufactured by MABIE, TODD & Co., 180 Broadway, New York. This and the next, No. 32, are, we think, really the best things of the kind manufactured. The fact that hard rubber is used, shows that the gold for the mountings, etc., is of the finest quality, as rubber, on account of the sulphur contained in it, can not be mounted with any other without tarnishing. When closed, the pencil No. 31 is only 5 inches long, (No. 32, 3½ inches,) but it opens to a length of 5¾ inches. The price for the holder and pencil of No. 31 is $6, pen $2; and of No. 32, or smaller size, $5 for the case, and $1 75 for the pen. Fifteen subscribers will give you the former, or gentleman's size, and 13 the latter, or lady's size. No. 33 is a No. 6 gold pen, with silver or gold-plated holder with an ebony handle—a very neat, desirable business pen. By describing the kind of pen you prefer, we can probably select one that will suit your hand perfectly. We send these by mail, in a neat turkey morocco box, lined with velvet, in which they can be kept, protected from injury, No, 34 is a large pen, in a fine extension case, round or fluted, and richly engraved. The gold is 14 carats fine. These pens, which are nicely put up in boxes, are a very beautiful thing for a present. Price $20, and sent, postage paid, to any address, upon receipt of 29 subscribers at $1 50 each. No. 35 is a lady's gold pen, with ivory holder. Price, $2 75. This is indeed a very neat and beautiful pen for ladies' use. We send it, postpaid, by mail, inclosed in a handsome velvet-lined morocco box, for 6 subscribers.

No. 38—The Celebrated St. Germain or German Student's Lamp.—as it is sometimes called. This lamp is made and furnished to us by C. F. A. HINRICHS. It scarcely needs eulogium, being the standard thing in our leading colleges, both among students and professors. They reject gas, even where it is most plentiful and convenient, and save their much-worked eyes by the motionless pure white light for which this lamp is so remarkable. No other artificial illumination approaches so nearly to the still colorless sunlight. The secret is in the scientific adaptation of burner and chimney to produce that perfection of draught by which absolute combustion is attained without vibration. The porcelain shade softens the light most agreeably. The lamp slides on a vertical standard, and is adjusted by a set-screw at any desirable elevation to accommodate the work or the eyes. The reservoir is elevated above and at a short distance from the burner, (communicating by a pipe,) so that the oil is always cool and out of reach of flame. The reservoir can be taken out of its telescopic socket, and carried away to another room and filled and returned, without putting out the light. The lamp will be a treasure worth no little trouble to obtain to any one who needs strong light, or who values eye-sight, economy, neatness, pure air, and freedom from trouble and annoyance with lamps; as in all these points it is without a peer. The price of these lamps is $8, with 25 cents for packing. The mineral sperm oil can be had from most respectable dealers, or ordered in packages of any size (1 gallon upward) from Messrs. HENRY RUSSELL & Co., 38 Park Place, New-York.

No. 39—Family Scales.—These scales combining the advantages of counter and platform scales, are peculiarly adapted to household purposes. They weigh from ½ ounce to 240 lbs. They have a scoop or pan for weighing flour, sugar, and other house stores, and a platform for heavier articles, and are just such an apparatus as is needed for in-door or out-door use, occupying less than two feet square. These scales are manufactured by the well-known FAIRBANKS & Co., No. 252 Broadway New York, whose weighing apparatus has long ranked as the standard in all parts of the country. Send to them for circulars, if desired.

Nos. 45-53—Bailey's Patent Planes.—To those who have used these planes and know their value, it is but small praise to say that they are superior to any others made. They are so far ahead of any others that there can be no comparison between them. They are self-adjusting in every respect. Both the wood and iron planes are entirely independent in themselves, requiring neither hammer, screw-driver, nor wrench to replace or adjust the cutter, which is held firmly in place and can be instantly released by use of the cam and its thumb-piece. The cutter is adjusted by simply turning a thumb-screw under the bed-piece upon which the plane-iron rests. By this the cutter can be adjusted to any thickness of shaving. The Stanley Rule and Level Co., 55 Chambers Street, New York, warrant these planes to be of the best stock and finish. The various numbers and sizes of these planes which we offer gives carpenters, mechanics, and others desiring them, an opportunity to get a complete set of either the wood or iron planes as premiums. The smooth planes, of which we offer two sizes, are 5⅛ inches long, 1¼ inch cutter; and 8 inches long, 1¾ inch cutter.

Jack plane..	14	in. long,	2	in. cutter.	Iron.
Fore "	18	" "	2¼	" "	
Jointer "	22	" "	2⅜	" "	

In the wood planes the lengths and widths of cutter embrace all sizes made. Forty-four subscribers at $..50 each, or 141 subscribers at $1 each, will get a complete set of the wood-planes. Sixty-nine subscribers at $1.50 will get a complete set of the iron planes, which will last a life-time. If larger sizes than those given are wanted, a few extra subscriptions will be required, according to the difference in the price.

Nos. 54-76—Machinists' Tools.—This series of premiums, consisting of machinists' tools, etc., has been selected and put up at the suggestion of several practical men with whom we have consulted in regard to the subject. These gentlemen, who have a practical knowledge of the tools, and of the requirements of all who have any thing to do with the working of metals, give their unqualified approval of the tools we have selected. This list of premiums has been made so extensive that every man who has any industrial operrtions to carry on will find some tool or tools absolutely necessary to him. By sending us clubs of subscribers to THE MANUFACTURER AND BUILDER these tools may be obtained by the smallest possible amount of labor. Of the qualities of these tools, in point of finish, we know them to be the best in the market—the best, without challenge. When a man has a set of any of them in his tool-chest, he knows he has the means of producing work equal to any that can be done. We obtain these tools from the general agents, Messrs. FOST & GODDARD, 109 Liberty Street, New York.

No. 77—Foot-Lathe No. 1.—Of these useful articles we offer two kinds. No. 1 is perfectly adapted for most kinds of turning in wood or metals; also drilling, boring, polishing, sawing, etc. It seems to be the size desired by most people. This is proved by the great numbers of them sold. This lathe takes a piece between centres 19 inches long and 6¼ inches wide in diameter. It weighs 200 pounds. It is fitted with two pointed centres, one spur-centre, face-plate turned and polished, twe rests, one 9 and the other three inches long; also centre key and wrench combined, which fits the screw heads in different parts of the lathe. The balance-wheel weighs 45 pounds, is turned true, and is polished. It has two sizes for change of speed. This size of lathe has a great many extra parts made for it, so that whenever they are wanted they can be obtained. This is a very valuable point, as in buying other machines of the kinds only such things as happen to fit can be used, and they are not always to be found when wanted. The Rev. JOHN TODD, D.D., speaking of lathes, says in regard to these, "For price, for finish, for beauty and workmanship, I have never seen any American lathe so desirable. Of the No. 1 he says: "Nobody can own the lathe without daily gratitude." We procure these lathes through Mr. LUCIUS W. POND, 98 Liberty street, the well-known manufacturer of machinists' tools. Few people can obtain one of these lathes more easily than by obtaining 65 subscribers for THE MANUFACTURER AND BUILDER, for which we ship this premium, without any additional charge for boxing. The regular price is $50. We include leather belt 8 feet long, which costs 90 cents in the price given in the table.

No. 78—Foot Lathe, No. 2.—Our subscribers are frequently asking for second-hand lathes, saying at the same time that such a one would answer their purpose, and probably come cheaper. There are many others who do not care for so complete a lathe as No. 1. The No. 2, we think, will answer this demand. It is made of cheaper materials, but in the same style as lathe No. 1. The frame is of wood, with curved legs, which give it a neat and attractive appearance. It is painted and ornamented in the best style. The bed is made with iron slides three feet long. Will take a piece between centres 21 inchhes long and 6¼ inches in diameter. It has an iron pulley like No. 1. The spindle runs accurately. The face-plate takes off, and the centres are fitted to tapering sockets. Tailstock spindle traverses with a left-hand screw. Everything is well fitted and finished. The balance-wheel is the same pattern as for lathe No. 1, and is turned true. The lathe, with face-plate, long and short T rests, two pointed centres, spur-centre, and wrench, packed for transportation, costs $30. For this we also include the leather belt, 8 feet long, which is used on the driving wheel. We box this lathe and deliver it on the cars for a club of 47 subscribers at $1 50 each, or 124 at $1. The twist-drills and chucks—premiums 65, 66, and 69 to 73—especially the smaller sizes, are just the things for these lathes. The chucks, No. Ox, 2 and 3, cost $2 extra for fitting in the lathe. Those desiring further information in regard to the premium may send to WESTERN & Co., 37 Park Row, New York, for an illustrated pamphlet.

No. 79—The Dollar Steam-Engine.—This is a real working steam-engine and boiler, which runs half an hour, or until its fill of water is evaporated, by means of a small spirit-lamp, which forms a part of it. It can not explode or get out of order. A most instructive as well as entertaining toy. Sent, prepaid, for 5 subscribers at $1 50. It is manufactured by COLBY BROTHERS & Co.

Nos. 80, 81, 82, 83—Compact and Powerful Portable Steam-Engine and Boiler.—BAXTER'S patent is acknowledged by many experienced engineers to be the most perfect combination, of standard principles exclusively, and thorough workmanship, ever made in a portable engine. At the same time such is its compactness and the scale and system on which it is manufactured, (by the Colt Armory, at Hartford, Ct.,) that it is afforded at the lowest price ever known for the same (actual) power. It is made by machine tools constructed expressly for it, of standard interchangeable parts throughout, like the celebrated American watches. Consequently we are able to make it one of our most attractive and valuable premiums. Besides, it is warranted to consume less fuel per horse-power than any other engine. This is in consequence, partly, of the improved arrangement of the boiler and the cylinder being entirely let into the steam-space, to save room and heat. The one-horse engine and boiler (which, like the others, will run above, not below rated power) stands but five feet high, over all, by two feet in diameter. This is premium No. 80, costs $300, and can be had for 320 subscribers at $1 50 each, or 1125 at $1 each. The five-horse engine and boiler stands 6¼ feet high by 3 feet in diameter, costs $800, and can be had for 858 subscribers at $1 50 each. The ten-horse engine costs $1200, and will run a good sized manufactory. There is now no reason why any body should be without a first-class steam-engine, especially as these engines are so simple, snug, safe, and economical of fuel that they can be run in any apartment by the fire required to warm it, and by and person of common intelligence, and will be received from the factory in perfect readiness for use. For running small lathes, drills, etc., circular and scroll saws, printing-presses, corn-huskers, cider-mills, fanning-mills, feed-mills, cotton-gins and hullers, cheese-presses, churns, pumps, washing-machines, sewing-machines, rotary blowers for forges and other purposes, etc., the smallest of these engines will be found thoroughly effective, and as little incumbrance and trouble as a kitchen stove. For business, however, we recommend to try for one of ample rather than of bare sufficiency.

Nos. 84, 85, and 86—Steam-Pumps.—These steam-pumps are of the best class and quality, economical in the use of steam, and capable of being applied in various ways. No. 84 is one of Hardick's manufacture, which took the first prize at the Fair of the American Institute a year ago. Nos. 85 and 86 are two sizes of the celebrated Cameron pump. Nos. 1 and 2. The first has a steam cylinder 4½ by 7 inches, and its capacity of ordinary speed is 15 gallons per minute, and costs $150. Size No. 2 has a steam cylinder 6 inches in diameter, with 8-inch stroke. It costs $200, and is capable at ordinary speed of delivering 30 gallons of water per minute. These pumps are remarkable for their compactness, simplicity, and durability. The valves are large and not liable to become choked up. By simply removing the bonnet, access can be had to them for inspection or repair,

Nos. 105 to 108—To Procure a Patent without Money.—We have met with many having valuable inventions, which inventors are anxious to get patented, but are unable to afford the expense, and consequently fail to secure the profits which a patent might produce. To such as are in this position, we make the following liberal offer: No. 108—We will prepare an application for a patent, attend to its passage through the Patent Office, and pay all government fees and incidental expenses attending the same, for any inventor presenting a patentable invention, who will get up a club of seventy-five subscribers for THE MANUFACTURER AND BUILDER for one year at $1,50 each, or 250 at $1 each, and send us the money by post-office order. If this application should be rejected, they may send us an additional list of thirty subscribers at $1.50 each, and the subscription money for the same, on receipt of which we will prepare and prosecute a second application, paying all government fees and incidental expenses. No. 107—For a list of fifty subscribers at $1.50 each, or 150 at $1 each, with the cash accompanying it, we will prepare an application, attend to its passage through the office, and pay the government fee ($15), the applicant paying the second government fee of $20. No. 106—For a list of thirty-five subscribers at $1.50, sent in the same way, we will prepare and prosecute an application, the applicant paying the government fee. No. 105—for twenty-eight subscribers at $1.50 each, or eighty at $1 each, we will prepare and file a caveat, furnish the necessary drawings, (which we also furnish in all the above cases), and pay all government fees. All cases placed in our hands under these arrangements will receive our best attention, equally with those for which our fees have been paid in cash, and will be appealed to the Board of Examiners-in-Chief if necessary, the applicant paying the government fee of $10 on such appeal. If the inventor has no model to accompany his application, he may procure additional subscribers, the premium on which (see cash rates) will enable him to pay for the model. A club of 100 names has been obtained in a single establishment where from 150 to 200 hands are employed. A village of 500 inhabitants will take this number readily.

No. 129—Sewing Machines.—Your choice! A $65 machine for 65 subscribers, at $1.50 each.—It makes no difference to us which machine we send, or whether it is selected at first or at the last moment. No charge for boxing the machines; they go safely as freight. For circulars, giving full particulars in regard to style of machines, fixtures, etc., as well as instructions, send to **Grover & Baker Manufacturing Co., 495** Broadway, New York; **Florence Sewing Machine Co., 505** Broadway, New York; **Wilcox & Gibbs Sewing Machine Co., 658** Broadway, New York; **Singer Sewing Machine Co., 458** Broadway, New York.

Nos. 137, 138—Volumes of the Manufacturer and Builder.—The unbound volumes of THE MANUFACTURER AND BUILDER consist of a set of numbers for a year, each separate in its own paper cover. These volumes amount to a valuable Library on all matters pertaining to the Industrial Arts, and contain more varied information on manufacturing, building, and mechanical subjects than can be obtained in books costing three times as much. The price of the volumes unbound is $1.50 each, at the office, or $1.75 if sent by mail, as they must be post-paid. They are profusely illustrated, the engravings used in them having alone cost thousands of dollars. For ordinary use, the sets of numbers unbound will answer quite well.

Nos. 139, 140—Bound Volumes of the Manufacturer and Builder.—*New* subscribers almost invariably desire to secure the back numbers of THE MANUFACTURER AND BUILDER from its commencement. Some desire them bound in our uniform style, while others prefer to get the loose numbers and have them bound to suit their own tastes. *Our* binding is very neat, and being done in large quantities at one time, is furnished at a *very cheap* rate. It is moreover very handsome, being of cloth, with gilt title and back, sides embossed and ornamented with a neat architectural device stamped in gold. The price of the volumes is $2.50 each, sent post-paid.

No. 141—Covers for Binding the Manufacturer and Builder.—These are described in premium 139, 140. Now ready for 1869 and 1870. Be careful to state *which year* you require. Any country binder will insert the year's numbers in one of these covers at a moderate cost. Price, 50 cents; sent, *post-paid*, on receipt of three subscribers at $1,50 for each cover.

Nos. 143 to 154—Good Libraries.—In these premiums we offer a choice of books for manufacturers, mechanics, artisans, builders and others. The person entitled to any one of the premiums 142 to 153, may select any books desired from the list published in our Special Premium Sheet, to the amount of the premiums, and the books will be forwarded, post or express paid. $25 or $50 worth of books pertaining to the industrial arts will give the boys new ideas, set them to thinking and observing, and thus enable them to make their heads help their hands. Any good book will, in the end, be of far more value to a youth than to have an extra hundred dollars on coming to manhood. ☞ Let the mechanics of a neighborhood unite their efforts, and through these premiums get an industrial library for general use.

No. 154—General Book Premium.—Any one sending twenty-five or more names may select books from our list to the amount of ten cents for each subscriber sent at $1; or thirty cents for each name sent at $1.20; or sixty cents for each name at $1.50. *This offer is only for clubs of twenty-five or more. The books will be sent by mail or express, prepaid through by us.*

SPECIMEN COPIES, CIRCULARS, SHOW-BILLS, etc.,

will be furnished free of charge in sufficient quantities to meet the reasonable requirements of agents. We would respectfully request that they do not waste them, but distribute them judiciously. If some unexpected event should prevent them from continuing in the business, they will do the square thing by us by giving their outfit to some friend, who will continue the business where they have left off; and who will no doubt be grateful for the opportunity of receiving profitable employment.

Postage.

Every subscriber pays his own postage at the office where he receives the paper. This is only twenty-four cents per year, or six cents per quarter, payable in advance.

Don't Give up Your Town

until everybody has been supplied with a circular and has had a chance to subscribe; and be sure that you leave your address, so that they may know where to find you in case they should make up their minds to take the magazine after you have left them. Make all drafts, money-orders, and registered letters payable to the order of Western & Company, publishers, and address all communications

WESTERN & COMPANY, Publishers,
NO. 37 PARK ROW, NEW YORK.

TABLE OF CASH PREMIUMS For 1871.

EVERY MAN HIS OWN PAY-MASTER. STEADY EMPLOYMENT AND GOOD PAY.	PREMIUMS. At $1 50 each.	PREMIUMS. At $1 00 each.
For every club of 4 subscribers.....	$1 00	
" " " 10 "	3 00	
" " " 15 "	6 00	
" " " 20 "	10 00	
" " " 30 "	16 50	$1 50
" " " 40 "	24 00	4 00
" " " 50 "	32 50	7 50
" " " 75 "	48 75	11 25
" " " 100 "	65 00	15 00
" " " 200 "	140 00	40 00
" " " 500 "	350 00	100 00
" " " 1000 "	700 00	200 00

INTERMEDIATE CLUBS.

It often happens that clubs are made up of numbers that are not found in the above table. Names may be added to clubs at the following rates:

In clubs of	4	and less than	10	..	$1 25	for each name.	
" "	10	" "	15	..	1 20	" "	
" "	15	" "	20	..	1 10	" "	
" "	20	" "	30	..	1 00	" "	
" "	30	" "	40	..	95	" "	
" "	40	" "	50	..	90	" "	
" "	50	" "	200	..	85	" "	
" "	200	" "	500	..	80	" "	
" "	500	" "	1000	..	80	" "	
" "	1000 and over.....				80	" "	

The Profits of the Cash Business, it will be seen by the above tables, are large and accrue rapidly. Every experienced canvasser knows that it is far easier to obtain 4 subscribers to a paper like THE MANUFACTURER AND BUILDER at $1 50 each than to get 1 subscriber to a high-priced magazine, costing $6. This is more strikingly evident when the fact is taken into consideration that our paper, costing only $1 50, is ACTUALLY SUPERIOR IN EVERY RESPECT TO ANY THING OF THE KIND IN THE COUNTRY COSTING TWICE THAT SUM.

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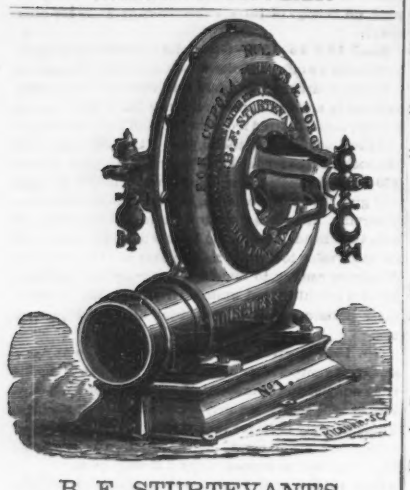

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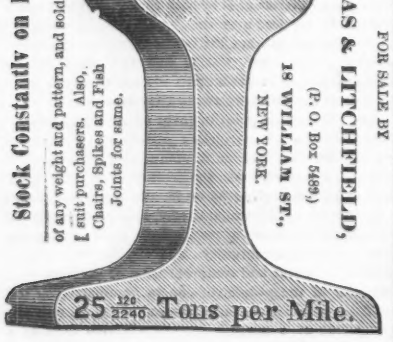

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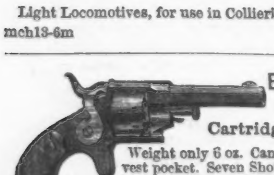

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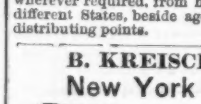

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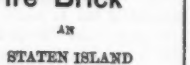

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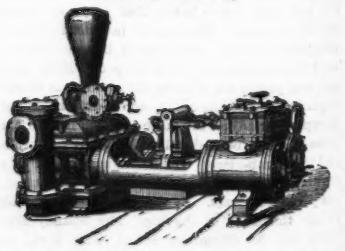

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